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THE GREAT CANTILEVER BRIDGE OVER NIAGARA RIVER.

This double track railroad bridge, completed within the past few days, was designed to connect the New York Central and Michigan Central Railroads. It is located about 300 feet above the old railroad suspension bridge, spanning a chasm 870 feet wide between the bluffs and over 200 feet deep. The banks of the river are formed of masses of broken rocks and immense bowlders reaching up to within about 60 feet of the level land.

As the foaming rapids at this point rendered it impossible to build piers in the river or erect temporary supports, it was necessary to design a structure which could be erected without such false work; to attain this end a bridge of the cantilever type was adopted which would be self-supporting during erection. The principle of the cantilever is that of a beam supported at or near its center, with arms extending both ways, one arm being held down by an anchorage or counterweight so that the load on the overhanging arm pro duces an uplifting force in the opposite end which is resisted by the counterweight. The designs of this structure were worked out jointly by C. C. Schneider, chief engineer in charge of the work, and Edmund Hayes, engineer of the Central Bridge Works.

The structure consists of two immense steel towers, 132 feet 6½ inches high, resting on stone piers 39 feet high. Each of these towers supports a cantilever 395 feet $2\frac{5}{16}$ inches long. One end of each tower rests upon an abutment at the edge of the bluff, while the other end extends out over the river. The shore ends of the cantilevers are anchored to the abutment masonry or anchorage piers, and both river arms are connected by an intermediate span of 120 feet which is suspended from the extreme ends of the river arms. The total length of the bridge proper is 910 feet 4⅝ inches between the centers of the anchorage piers; the clear span between towers being 470 feet. The height from surface of water to base of rail is 239 feet.

The towers are braced steel structures, containing four columns each, which are made up of plates and angles riveted together, braced with horizontal struts and tie rods. The batter of the columns at right angles to the center line of the bridge is 1 in 8, and parallel to the center line 1 in 24.

The trusses are two in number, 28 feet apart between centers; the various members being connected with steel pins 7½ inches, 6¾ inches, and 5⅜ inches in diameter, turned accurately so as to fit the bored pin holes within $\frac{1}{64}$ of an inch. The depth of the cantilever trusses over the towers is 56 feet, and at the shore ends 21 feet, and at the river ends 26 feet. The lower chords and centerposts are made of plates and angles riveted together and latticed, the intermediate posts being of 12 by 15-inch channels, latticed. The upper chords of the cantilevers are 8-inch eye bars, the shore arm having a compression member 18 inches deep composed of plates and angles packed between the chord bars. The shore ends of the cantilevers are attached to short links, oscillating on pins anchored to the abutment masonry, which serve as anchorages and also as rockers to allow for expansion and contraction of the shore arms produced by changes of temperature. Expansion joints are also provided for at the connection of the intermediate span with the river ends of the two cantilevers.

The material used in the superstructure is steel and wrought iron. Towers and heavy compression members, such as lower chords and center posts, are of steel, as are all pins. All tension members are of double refined wrought iron. The only use made of cast iron is in the pedestals on the masonry and in filling rings; the castings at the top of the towers are all steel. All materials were carefully inspected at the mills, and none was allowed to go into the structure without being properly tested and found to possess the strength, elasticity, etc., called for by the specifications.

The floor beams are 4 feet deep, of wrought iron, riveted between the vertical posts and made of plates and angles. There are four lines of longitudinal stringers, resting on top

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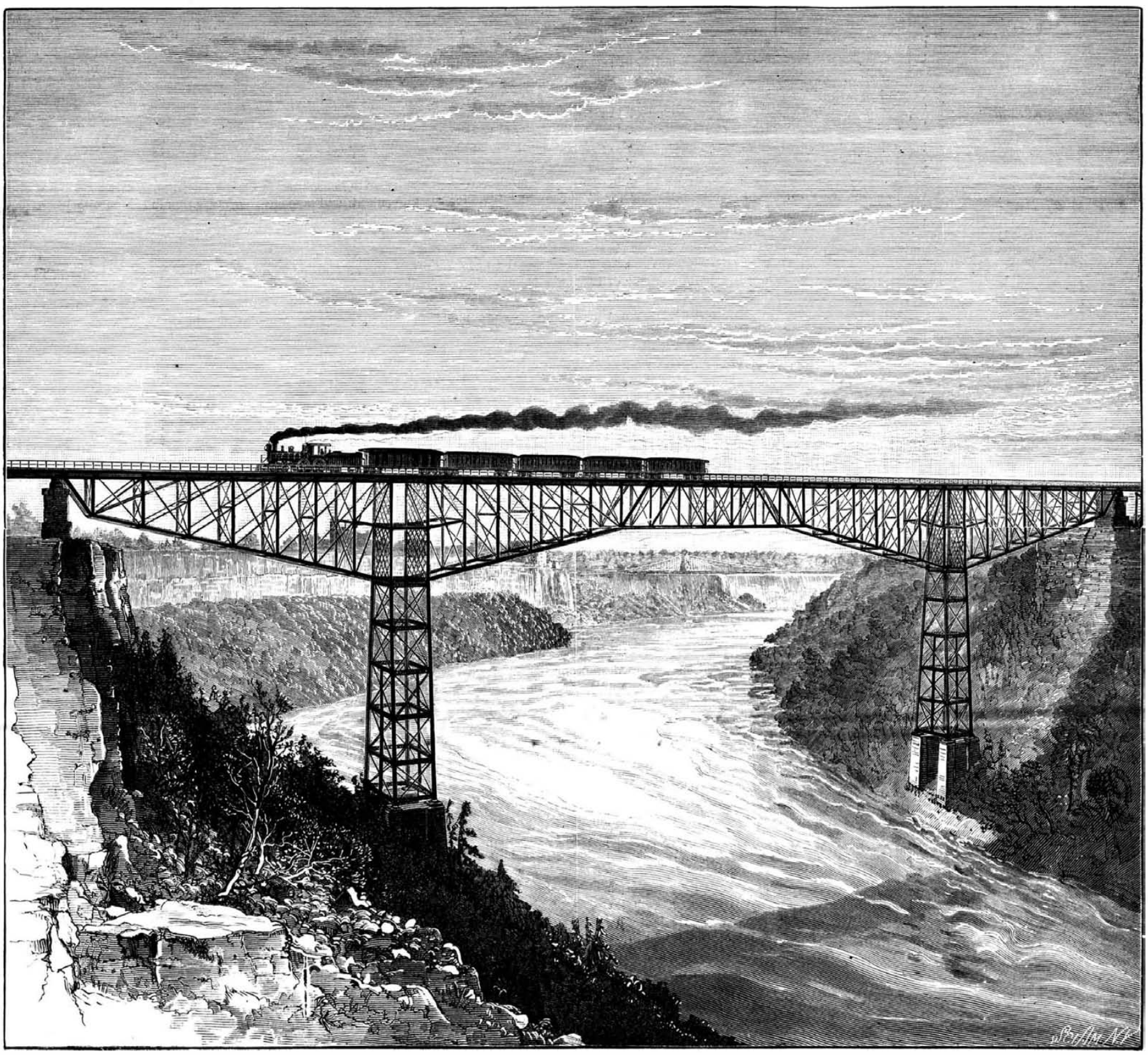

THE GREAT CANTILEVER BRIDGE OVER NIAGARA RIVER.

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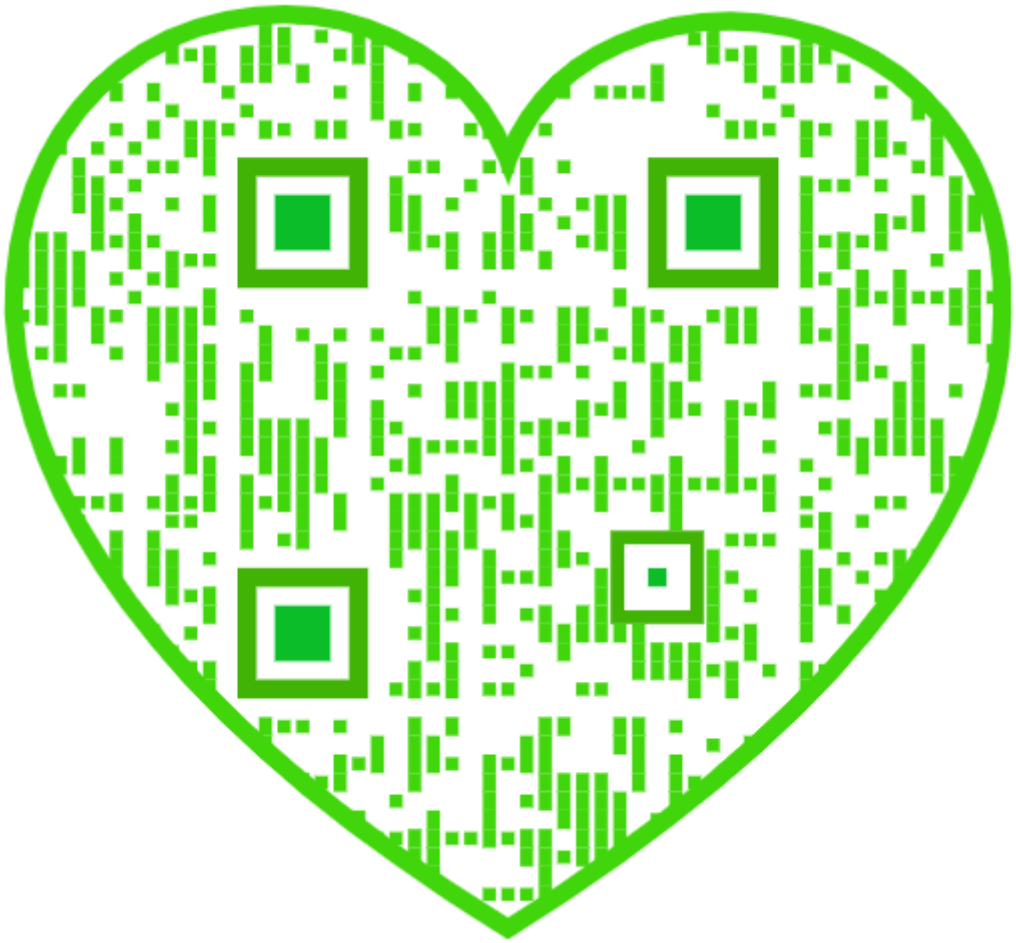

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THE USE OF ARGOL IN DYEING.

A considerable proportion of the argols annually imported into the United States is used for dyeing, in the state in which it arrives, instead of being refined for use in baking powders. It comes, as is well known, in very different states as to purity, but it is scarcely possible to find any samples, no matter how muddy or poor, which cannot be used in dyeing low grades of woolen stuffs, while for finer qualities a better quality of argols, even up to refined cream tartar, is required.

Although argols are employed by dyers as a mordant, they are seldom so used except in connection with another mordant, when their curious chemical constitution enables them to be used for two directly opposite purposes. They in some cases act as an acid, because their tartaric acid can be so readily set free; and in other cases they act as an alkali, because their potassa serves to neutralize the too powerful acid of the other mordant. A single illustration may suffice. The brilliant, beautiful red of the British uniform is known the world over. It owes its splendor of color to argols. Of course the fine cloth worn by officers, especially of high rank, must be treated with the utmost refinement of skill. Twenty pounds of "spirits of tin" are reckoned enough for 100 pounds of cloth. Thirteen pounds of this are boiled for two hours with eight pounds of refined argols, a few ounces of cochineal going with it, just barely to report progress.

This decoction is then poured upon the cloth, the remaining seven pounds of "tin spirits" are added, together with six pounds of cochineal, boiled still further, and for common purposes the work is done. But if a specially "fiery" red is needed for the highest grades of uniform, these argols are all that is required, and the splendid color remains as their trophy. They acted here first doubtless as an alkali, and then in all probability as an acid.

One form of Prussian blue is also worked out on such goods as merinoes, through the agency of argols, and they are used extensively in dyeing black, especially cloths of rather low grade.

Charles William Siemens.

Sir Charles William Siemens, D.C.L., LL.D., F.R.S., the well known scientist, engineer, and electrician, died in London, on the 20th ult., of rupture of the heart. Dr. Siemens was born at Leuthe, Hanover, April 4, 1823, and belonged to a distinguished family of scientists.

He was educated at the Gymnasium of Lubeck, the art school of Magdeburg, and the University of Göttingen. He entered Count Stolberg's engine works as a pupil in 1842, and in 1843 and 1844 visited England to introduce and patent a gilding and silvering method of his brother Werner's and a differential governor for steam engines invented by him and his brother.

He ever afterward made England his home, becoming a naturalized citizen in 1859. In 1849 he and his brother Werner became famous for their process of anastatic printing, Professor Faraday delivering a lecture about it before the Royal Institution. During the following three years Sir William was occupied at times with the chronometric governor. Several of these governors are used in the Royal Observatory at Greenwich for controlling the motion of transit and recording instruments. About the same time he also brought out his double cylinder air pump. In 1847 he turned his attention to the then new study of the dynamical theory of heat, and also the use of a regenerator for recovering that portion of the heat which presents itself at the exhaust port of a caloric engine. In 1851 he introduced his water meter, which has been used extensively. Between 1856 and 1861 he worked out, in conjunction with his brother Frederick, the regenerative gas furnace. While working upon this furnace Sir William also sought to make steel and iron direct from the ore. With this object in view he constructed his sample steel works at Birmingham in 1866, and in 1867 he sent several samples of steel produced in this way to the Paris Exhibition. Since then he has continued to manufacture steel upon the open hearth of his regenerative gas furnace. In 1868 he originated the Landore Siemens steel works, which manufacture upward of 1,000 tons of cast steel per week.

Ever since 1848 Dr. Siemens has been interested in telegraphy, and has occupied a prominent position in the development of electrical appliances. In 1858 he established, with his brothers Werner and Carl and Dr. Halske, of Berlin, the works now known as those of the Siemens Brothers, in London, Berlin, and St. Petersburg. He planned and had built the steamer Faraday for laying ocean cables, and at their Woolwich factory the brothers manufactured several of the Atlantic cables, the North China cable, and the wires for several other telegraph lines. In the department of electric lighting he was esteemed second to no one in England, either in theoretical knowledge or successful practical application. He and his brother Werner were the inventors of the well known Siemens electric lamp. His name is also connected with many other inventions.

Many honors were bestowed upon him, all countries recognizing and appreciating his ability. He received the Telford medal of the Institution of Civil Engineers; was elected a fellow of the Royal Society in 1862; member of Council of Institution of Civil Engineers and of the British Association; a manager and vice-president of the Royal Institution; and was once president of the Institution of Mechanical Engineers. He was first president of the Society of Telegraph Engineers. In February, 1877, after having visited this country, he was made an honorary member of the American Philosophical Society, and in October, of the same year, became an honorary member of the Gewerbe-Verein, of Berlin. He was a member of the Athenæum Club and of the Philosophical and Royal Society Clubs. In 1869 Oxford University conferred upon him the degree of Doctor of Laws, and in 1874 he received the Royal Albert medal for his researches in heat and his metallurgical processes. In 1875 he received the Bessemer medal of the Iron and Steel Institute for his services to the iron and steel trades. He was appointed first a commander and subsequently a dignitario of the Brazilian Order of the Rose.

Effect of Frost on Fire Plug Casings.

At a recent meeting of the Engineers' Club of Philadelphia Mr. Allen J. Fuller referred to a general impression that the freezing of the earth around fire hydrants has a tendency to gripe fast to the frost jacket and lift it with the expanding or heaving earth, which he denied for the following reasons;

1. The frozen earth slides on the surface of the frost jacket, because its expansion is greater than that of iron.

2. As the expansion of the earth must be in proportion to the intensity of the cold, so will it be greater above than below a given point, therefore the first foot of frozen ground will have a greater upward movement than that which is below it, and the second foot greater than the third, etc. Thus it will be seen that the earth below a given point rises more slowly than that above, and its friction is opposed to the one above.

3. If this is true of feet it is true of inches, and of portions of an inch, therefore there is a retardation movement throughout.

4. The upward movement of the ground, the freezing being greatest toward the surface, and such movement involving a more complete fracture of the earth surrounding the frost jacket, it follows that the friction is less at this point than that below it, and in consequence there is less power to move upward than downward.

Of course the above does not apply to any construction that the frost can get beneath.

Professor Haupt remarked that he thought the theory was in part sustained by the fact observed by some of the district surveyors, and verified by the accurate measurements they were obliged to make, that fences moved bodily to the south and east in consequence of the action of the sun and frost upon the ground on opposite sides of them. He thought also that the deductions concerning the immobility of structures resting below the frost line was not fully sustained by the facts as, in the Northwest, where ice forms rapidly, he had heard of numerous instances of piles, driven for bridges and extending some distance below the frost line, having been raised as much as five to six inches in a single night, and he conceived the action in this case to be similar in kind to that of piles driven entirely through solid ground, the only difference being in the *amount* of the resistance offered by friction and weight of pile. The water in freezing around the pile acts upon it as a gripper or vise, and the expansion of the various strata or laminæ of water as they become converted into ice act as levers to force up the pile.

Mr. Howard Murphy did not consider the case cited by Professor Haupt as parallel, as the so-called piles, being driven through water and soft mud, were probably columns resting upon their bases and depending but little upon the frictional resistance of the material through which they passed. Therefore the expansive force upward of the freezing water would be opposed by little more than the weight of the pile, whereas in a fire hydrant casing or other deeply planted post the presumably well rammed material around the whole length underground would offer such proportional frictional resistance as to cause the freezing earth to slide up the post rather than to lift it. If the ice could be supposed to act downward upon the piles in question, it is hardly likely that it would have forced them further home.

A Novel Clock.

A gentleman in Brussels claims to have contrived a perpetual clock. It was started in the latter city about one year ago, and up to a recent date is said to have been running perfectly. An up draught is obtained in a tube or shaft by exposing it to the sun. This draught turns a fan, which winds up the weight of the clock until it reaches the top, when it actuates a brake that stops the fan, but leaves it free to start again after the weight has gone down a little, and thus the power is stored for keeping the clock in motion.

Improved Projectile.

Krupp, the noted gun maker of Essen, has just taken out a patent on a flat-headed artillery projectile. The pointed projectiles, as is well known, are apt to deflect when striking iron plates or water at certain angles. The new projectile, slightly tapering at the butt, will not only pierce the plates all the more easily, but is also calculated to hit the ironclads below the water line. In order that the resistance of the air against the flattened head may not impede the celerity of the projectile, the latter is provided with a pointed tin cap, filled with grease, which cap drops off on striking the object.

IN an article on the "Traveling Electric Light," on page 287 of this journal, credit should have been given to our contemporary *La Lumière Electrique*, for the illustrations and description of the apparatus.

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ASPECTS OF THE PLANETS FOR DECEMBER.

URANUS

is morning star, and holds the place of honor on the planetary record of December, for he is the only planet whose progress on the celestial track is diversified by a noteworthy incident. On the 20th, at 2 o'clock in the afternoon, he is in quadrature with the sun, having accomplished half his journey from conjunction to opposition.

Uranus has of late been in an exceptionally favorable situation for observations concerning his disk and figure. The last time he was in an equally favorable position was in the years 1842 and 1843. Professor Young has improved the opportunity for viewing him in the great Princeton telescope. He detected markings on his disk, shadowy resemblances of the belts on Jupiter's disk, and hopes to use them as the data for determining the time of the planet's axial rotation. Schiaparelli, of Milan, has employed the same favorable opportunity for making a series of observations on the figure of Uranus. His observations agree with those made by Professor Mädler in 1842 and 1843, and indicate that Uranus is the most elliptical of all the planets, excepting Saturn.

To those who have only seen Uranus through an ordinary telescope as a tiny sphere of a delicate sea-green hue, it seems almost beyond belief that a powerful telescope wielded by a practiced hand can bring to view belts on his disk and an elliptical outline to his figure.

The right ascension of Uranus is 11 h. 52 m.; his declination is 1° 36′ north; and his diameter is 3·6″.

Uranus rises on the first about 1 o'clock in the morning; on the 31st he rises a few minutes after 11 o'clock in the evening.

JUPITER

is morning star, the present being the last month in which he will play this part for some time to come. He will be the most superb object in the heavens on moonless nights throughout the month, appearing now above the horizon at half-past 8 o'clock, and rising earlier every night, until at the close of the month his shining face looms above the eastern hills at half-past 6 o'clock. It seems anomalous to call a planet that rises so early in the evening a morning star, but astronomers class the outer planets as morning stars from conjunction to opposition, without regard to the time of rising.

The famous red spot that for five years formed an interesting feature on the planet's disk faded rapidly away during the last winter and spring, and has not been seen since the middle of May, when it was exceedingly faint. No one can tell if it will be seen again, for no one knows the cause that produced it. If any vestige remains, it is safe to say that it will be found by some of the eagle-eyed observers who are diligently scanning the face of our giant brother.

Interesting telescopic observations have been made on the Jovian disk that give positive indications of an atmosphere enveloping the huge planet. Satellites and stars when occulted disappear and then flash up again. This phenomenon has been frequently observed, and can be explained by the intervention of clouds in the planet's atmosphere. In the case of occultations, clouds may intercept temporarily the light of satellites or stars, which may flash up again as soon as the clouds have passed. In the case of satellites eclipsed by the shadow of Jupiter, the flashing up at intervals of the light of the satellites may be caused by their passage through darker regions in the penumbra of the planet's shadow due to such clouds.

Professor Pickering, of the Cambridge Observatory, records a very interesting observation made by him on the 14th of last April. A star of the seventh magnitude was occulted by Jupiter a little more than two hours after midnight. For about two minutes before the final disappearance the star alternately disappeared and reappeared without any obvious reason, as if it were playing hide-and-seek with the clouds. The immersion of the star about twenty-eight minutes afterward took place in the most orderly manner without a single fluctuation of light. These little incidents are of great moment in the attempt to find out the constitution and physical conditions of the huge planet. It is by heaping up such observations in boundless measure that results bearing some impress of certainty will finally be reached.

Those who are unable to make telescopic researches concerning the Jovian planet can at least admire his stately and majestic appearance in the starlit sky, where he reigns supreme during nearly the whole time that darkness veils the earth.

The right ascension of Jupiter is 8 h. 27 m.; his declination is 19° 35′ north; and his diameter is 40·8″.

Jupiter rises on the 1st at half-past 8 o'clock in the evening; on the 31st he rises at half-past 6 o'clock.

MARS

is morning star. He may be readily recognized by his proximity to Jupiter, being a short distance southeast of his far more brilliant rival. Though comparatively small, he is not a planet to be despised, especially when within two months of opposition. He seems just now to be running away from Jupiter and to be running after Regulus, the bright star on the east of him. His short reign, however, will soon commence, when for a month before and a month after opposition, the culmination of his brilliancy for the present will be reached.

The right aseension of Mars is 9 h. 30 m.; his declination is 17° 25′ north; and his diameter is 10·4″.

Mars rises on the 1st about a quarter before 10 o'clock in the evening; on the 31st he rises a few minutes before 8 o'clock.

SATURN

is evening star. He has commenced his travel toward the sun and from the earth. He is therefore receding from us and growing less bright than when in opposition. But the diminution is not yet perceptible. As soon as darkness covers the earth, he takes his place among the stars, slowly receding from the neighborhood of the gentle Pleiades and ruddy Aldebaran as he makes his way over the celestial track. Every observer has a kind word for the planet so softly shining, and no one privileged to behold him in a large telescope will ever forget the magnificent picture.

The right ascension of Saturn is 4 h. 19 m.; his declination is 19° 24′ north; and his diameter is 19·4″.

Saturn sets on the 1st at a quarter before 7 o'clock in the morning; on the 31st he sets soon after half-past 4 o clock.

NEPTUNE

is evening star. He threads his course over the starry concave with snail-like pace, and is above the horizon nearly the entire night. As he cannot be seen, he is of little account to the ordinary observer.

The right ascension of Neptune is 3 h. 8 m.; his declination is 15° 46′ north; and his diameter is 2·6″.

Neptune sets on the 1st about half-past 5 o'clock in the morning; on the 31st he sets about half-past 3 o'clock.

VENUS

is evening star and will soon put on glorious apparel. Before the month closes, there will be no difficulty in finding the fairest of the stars in the western sky. She is now above the horizon about an hour after sunset, and must be looked for two and a half degrees south of the sunset point. At the close of the month, she is above the horizon two hours after sunset and must be looked for about two and a half degrees north of the sunset point. She will then set a few minutes after Jupiter rises, a charming sight for observers who can command a clear view of the eastern and western horizons.

The right ascension of Venus is 17 h. 48 m.; her declination is 24° 20′ south; and her diameter is 10·8″.

Venus sets on the 1st at half-past 5 o'clock in the evening; on the 31st she sets about half-past 6 o'clock.

MERCURY

is evening star and is swiftly making his way from superior conjunction to eastern elongation.

The right ascension of Mercury is 16 h. 42 m.; his declination is 23° 27′ south; and his diameter is 4·6″.

Mercury sets on the 1st not far from half-past 4 o'clock in the evening; on the 31st he sets at 6 o'clock.

THE MOON.

The December moon fulls on the 13th at 20 minutes after 10 o'clock, Washington time, 12 minutes later New York time, and 24 minutes later Boston time. On the 1st, at 27 minutes after 4 o'clock in the morning, the new moon of the 29th of November is in conjunction with Venus, being 5° 9′ north. On that evening the moon sets about two hours, and Venus one hour after the sun. Sharp-sighted observers may pick up the fair star and the slender crescent, though they will be beyond their nearest approach and not close together. This will be the first of a series of views in which during the winter we shall enjoy some of the most charming pictures ever painted on the celestial canvas—that of Venus and the young moon in conjunction.

On the 11th, the moon pays her respects to Neptune at a respectful distance north. It will be remembered that conjunctions among the heavenly bodies take place when the longitude or right ascension is the same, regardless of the difference in latitude or declination. On the 12th, the moon makes a close conjunction with Saturn, being 55′ south. In some positions in southern declination, between 18° and 71° south, Saturn is occulted by the moon for the 9th and last time during the year. On the 16th, the moon is at her nearest point to Jupiter; on the 18th, to Mars; on the 21st, to Uranus; and on the 31st, to Mercury.

On the 31st, she has made the circuit of the planets and swings round for the second time to the near neighborhood of Venus. The conjunction takes place at twenty-two minutes past 2 o'clock in the afternoon, when Venus is 6° 51′ south. Star and crescent will make a lovely picture on the early evening sky. The moon sets on that evening two hours and a half, and Venus two hours after the sun, and the charming exhibition of celestial glory can be seen without money and without price.

BACTERIAL DISEASE OF THE IMPORTED CABBAGE WORM.

Prof. S. A. Forbes, State Entomologist of Illinois, has found larvæ of *Pieris rapæ* (the imported cabbage worm) seriously affected around Normal, Ill., by a disease which in a few hours causes them to decay and reduces them to a black, almost fluid condition, dissolving at the touch. He finds the disease due to immense numbers of bacteria, excessively minute, and that they can be cultivated artificially in beef broth and thus introduced and propagated among healthy insects.

This black rot of the cabbage worm has been known to us for some years, and is quite widespread. We have made reference to it on page 70 of our *Bulletin* on the cotton worm (1881), in connection with some experiments with yeast ferment, in the following words: "An incident connected with these experiments which I made is, however, well worthy of being mentioned, because it shows how very easily single experiments may lead to false hopes and conclusions. A certain proportion of the last named larvæ (*P. rapæ*)—the proportion differing in the lots treated—perishing before, or while transforming to the chrysalis state. They became flaccid and discolored, and after death were little more than a bag of black putrescent liquid. I should have at once concluded that the yeast was a success had I not experienced the very same kind of mortality in previous rearing of this larva, and had I not, upon returning to the field from which the larvæ in question were obtained, found a large proportion similarly dying there.—*C. V. Riley.*

Copper Sulphide.

H. Schultze has recently published in the *Journal fur Prakt. Chemie* an interesting memoir on soluble antimony trisulphide, in which it is pointed out that perhaps other sulphides will also prove to be soluble. M. Spring, having to prepare pure sulphides and oxides which were needful in an investigation with which he was engaged, had the opportunity to observe that several of these bodies can easily be obtained in the colloidal state. The observations of Schulze concerning the solubility of antimony and arsenic trisulphide in pure water completely agree with the author's results. He finds further that copper sulphide is readily and completely soluble in pure water on proceeding as follows:

A dilute solution of copper sulphate in ammonia is treated with a current of sulphureted hydrogen until all the copper is thrown down as sulphide. The black precipitate is then washed by decantation with sulphureted hydrogen water. As soon as ammonia sulphate or hydrosulphate is no longer present in the washings, the sulphide passes gradually into solution, and there is ultimately obtained a black liquid with a slight greenish fluorescence. This black liquid passes like water through a filter. On examining it in a stratum of 2 centimeters in depth the colors appear brown and the presence of suspended copper sulphide cannot be admitted; the solution is clear. This solution can be boiled without decomposition, and if gently evaporated on the water bath, the sulphide is left as a black varnish. Small quantities of solution of salts quickly cause the black liquid to coagulate, especially when the liquid is hot. Precipitated copper sulphide, which is then readily taken up by water in the colloidal state, loses this property, even if dried in a vacuum at common temperature. The author adds that the pure dry copper sulphide thus obtained is not black, as generally asserted, but of a fine dark green. If submitted to a pressure of 6,500 atmospheres it forms blocks of a deep blue metallic luster. Manganese peroxide, obtained by treating manganous hydroxide with hypochlorous acid, passes when perfectly washed into a deep brown solution. The behavior of antimony trioxide, tin oxide, and tin sulphide is similar. The author has obtained more than 50 grammes of this body as a reddish brown transparent nitrous mass by evaporation in a vacuum of sulphuric acid.

How the Inventor Plagues his Poor Wife.

A facetious chap connected with one of our daily newspapers give the following amusing burlesque on the trials of an inventor's wife:

"It is all very well to talk about working for the heathen," said one, as the ladies put up their sewing, "but I'd like to have some one tell me what I am to do with my husband." "What is the matter with him?" asked a sympathetic old lady. "William is a good man," continued the first, waving her glasses in an argumentative way, "but William will invent. He goes inventing round from morning till night, and I have no peace or comfort. I didn't object when he invented a fire escape, but I did remonstrate when he wanted me to crawl out of the window one night last winter to see how it worked. Then he originated a lock for the door that wouldn't open from midnight until morning, so as to keep burglars out. The first time he tried it he caught his coat-tail in it, and I had to walk around him with a pan of hot coals all night to keep him from freezing." "Why didn't he take his coat off?" "I wanted him to, but he stood around till the thing opened itself, trying to invent some way of unfastening it. That's William's trouble. He will invent. A little while ago he got up a cabinet bedstead that would shut and open without handling. It went by clockwork. William got into it, and up it went. Bless your heart, he staid in there from Saturday afternoon till Sunday night, when it flew open and disclosed William with the plans and specifications of a patent washbowl that would tip over just when it got so full. The result was that I lost all my rings and a breastpin down the waste pipe. Then he got up a crutch for a man that could also be used as an opera-glass. Whenever the man leaned on it up it went, and when he put it to his eye to find William, it flew out into a crutch and almost broke the top of his head off. Once he invented a rope ladder to be worn as a guard chain and lengthened out with a spring. He put it round his neck, but the spring got loose and turned it into a ladder and almost choked him to death. Then he invented a patent boot heel to crack nuts with, but he mashed his thumb with it and gave it up. Why, he has a washtub full of inventions. One of them is a prayerbook that always opens at the right place. We tried it one morning at church, but the wheels and springs made such a noise that the sexton took William by the collar and told him to leave his fire engines at home when he came to worship. The other day I saw him going up the street with a model of a grain elevator sticking out of his hip pocket, and he is fixing up an improved shot-tower in our bed-room."

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Dividing Profits with His Workmen.

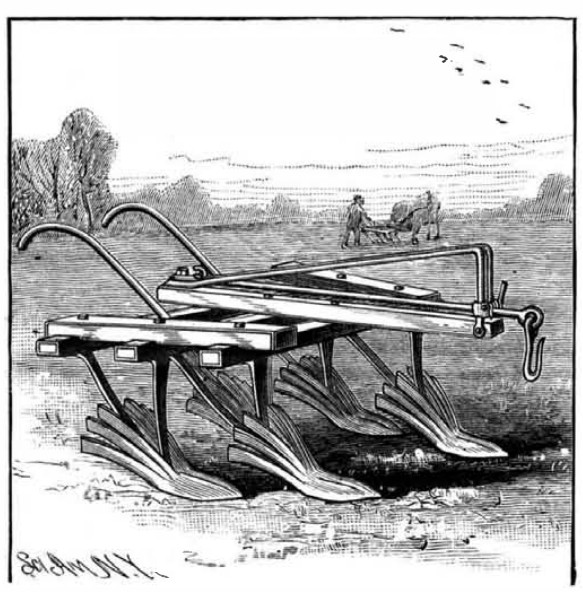
At the French Association for the Advancement of Science an interesting account has been given of the successful application of the system of admitting workmen to a share of profits in the large cotton printing establishments of M. Besselievre, near Rouen. The Pall Mall *Gazette*, referring to the subject, states that M. Besselievre does not, indeed, give his hands a share in the management and risks of his business. He keeps his books to himself, and pays them the wages ruling in the district, like ordinary laborers. But in addition to their wages he has since 1877 distributed among all the workmen who have been in his service for five years an annual bonus proportionate to his own profits, which has amounted on the average to 12 and in one instance reached 17 per cent of the wages earned by them during the year. Half of this bonus is paid to the men in cash, and half is retained to form a sick and pension fund and to provide for the family of the workman in the case of his death. This money is invested in the business at the rate of four per cent, but it is not confiscated if the workman is dismissed. To give the best of guarantees against capricious dismissal, moreover, the right to discharge a workman has been ceded by M. Besselievre to a committee, of which the majority consists of persons engaged in the factory. M. Besselievre has disbursed 80,000 francs in the last six years in these extra payments to his workmen, but considers himself to have been commercially the gainer by his liberality, owing to their increased devotion to their work and attachment to their employer. The success of such experiments wherever they have been tried ought to encourage more frequent imitation.

Enterprise in Dakota.

The following good story, which illustrates the rapidity with which towns are built up in new Territories, was told the *Northwestern Lumberman* by a gentleman who was looking around in Dakota recently. He was present when officials of the Chicago, Milwaukee & St. Paul road arrived at a point thirty miles north of Mitchell and planted a town which they called Woonsocket. At the time only one farm house was standing in the vicinity, and a car was used as a depot. This was on Thursday, and on Saturday of the same week there were twenty shanties, a livery stable, two stores, a saloon, a hotel, and three lumber yards. There are men who have loaded lumber on cars without knowing where it would be unloaded, and then run it to the first new town they hear of being started. But it is not best to imagine that all of the yards which are established so suddenly in the new Dakota towns have complete assortments or are models of neatness. A few hundred feet of lumber thrown down by the track constitutes a yard, which grows and is put into shape as the town progresses.

CULTIVATOR.

The plows, in the cultivator herewith illustrated, are made with angular forward parts, and have their rear parts cut into strips bent into the form of mould boards and twisted through a quarter of a turn, so that the soil may sift through while the weeds will fall to the ground from the rear ends of the strips. Each plow is connected to the frame by two standards of unequal length, so that they are firmly supported against the draught strain. The frame is formed of three cross beams connected near their ends by two side beams, and at the center by a beam projecting in front to serve as the draw beam, and to its forward end are secured two parallel rods, which extend nearly vertically upward for a suitable distance, when they are bent to the rearward and secured to that end of the beam. The draw rod passes



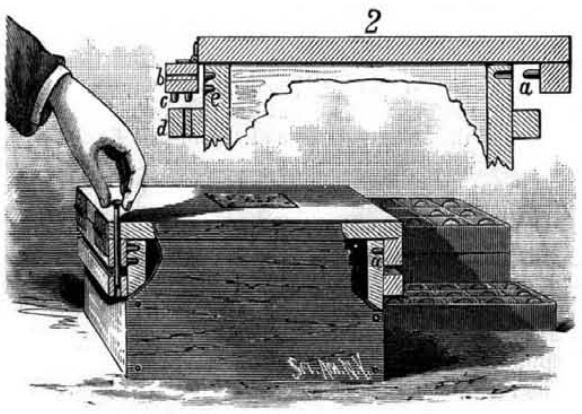
PLATTEN'S IMPROVED CULTIVATOR.

forward between the parallel or guide rods, and its forward end is provided with a hook for the attachment of the draught. The draw rod passes through a clamp, by which it can be held at any point on the upright parts of the guide rods, thus regulating the depth to which the plow works. The forward parts of the plows are made angular and nearly flat, and run beneath the surface, cutting off the roots of the weeds.

This invention has been patented by Mr. John Platten, Sr., of Fort Howard, Wis.

BOX FASTENER.

The object of an invention recently patented by Mr. James R. Morrison, of Oakdale, Ill., is to provide a fastening for the covers of egg cases or other boxes, whereby the cover can be held firmly on the box and can be removed easily and rapidly. One end of the box cover is provided with a fixed cleat having one or more dowels, *a*, and the opposite end has a hinged cleat, *b*, also furnished with dowels. The dowels in the fixed cleat are passed into holes in one end of the box, and those on the hinged cleat into holes, *e*,



MORRISON'S BOX FASTENER.

in the other end of the box. The hinged cleat is then locked in place by a pin or bolt, which is passed through the cover, the hinged cleat, and a fixed cleat on the end of the box, as shown in the perspective view. Fig. 2 is a section through the cleats and box.

BARREL PUMP.

The device is attached to the barrel by means of a bung tube, *d*, within the upper end of which fits a short tube, *a*, through which passes the pump tube, *e*, provided at its lower end with sharp points, *i*, that are to be embedded into

GUIGNON'S BARREL PUMP.

the barrel for staying the bottom of the pump tube and steadying the device while pumping. The pump and plunger are of the ordinary construction. The bottom of the tray, *h*, is made conical, so that the drain will be from center to circumference. Near the edge of the tray the bottom is provided with a short tube, *a*, through which the drip finds its way from the tray back into the barrel, thereby avoiding the use of a separate drip pipe. The detachable brace, *f*, is formed at one end with a sleeve, *c*, that fits upon the bung tube, and at the other end with a crosspiece that fits in the channel formed upon the bottom of the tray, serving to support the tray and prevent vibration. A guard with radiating arms is placed in the tray to prevent articles from falling upon the bottom. The vessels to be filled stand upon this guard. The pump is simple in construction, and is firm and steady while being operated.

This invention has been recently patented by Messrs. L. E. and E. E. Guignon, of Corry, Penn.

Conscience in Boiler Making.

We are sometimes very much annoyed by the want of good faith in boiler construction. There seems to be a feeling, certainly on the part of some, that a little departure from the correct thing is of little account if it will only pass. One of the tricks is to use thinner iron for the construction of the shell in places where the lap of the sheet is inside. For instance, if a boiler shell is constructed of three sheets in length, the outer sheets will overlap the center sheet and prevent the edges being seen unless one gets into the boiler. Now it is not unfrequently the case that this center sheet is of thinner iron than the other sheets. An inspector discovers this when making the internal examination.

In casting up the safe working pressure of a boiler, the strength of the weakest point must be the highest limit allowed for bursting pressure, and the factor of safety must simply reduce the pressure which would burst the boiler to a safe working pressure. Now the thinner the iron the less resistance it affords, and if the thin sheet is the weakest point, it must be made the basis for calculating the safe working pressure, which would be lower than would be allowed if the sheets in the boiler were of uniform maximum thickness. We call attention to this fact because the discovery of such practice has made serious trouble between the boilermaker and the steam user.

This business is sometimes carried so far that the edges of the plates are "upset" so as to appear thicker and heavier than they really are. We would not believe that there were men so blind to the duties and obligations which rest upon them as to resort to such practice, but the careful inspector finds all such defects, and in time we come to know whose work is carefully and honestly done, and whose is open to suspicion. In States and cities where inspection laws are in force that give the methods and rules by which the safe working pressure of a boiler is calculated, there is no alternative except to follow the rules; and if certain requirements regarding construction are a part of the law, there is no authority or right to depart from it, and yet there are boilermakers who try to force their boilers into such localities when their work is not up to the requirements of the law. Now this boiler making is pretty serious business, and inasmuch as some one must be blamed when accident occurs, it is important that all who have to do with boilers, from their construction to their care and use, shall be honest in all their work.—*The Locomotive.*

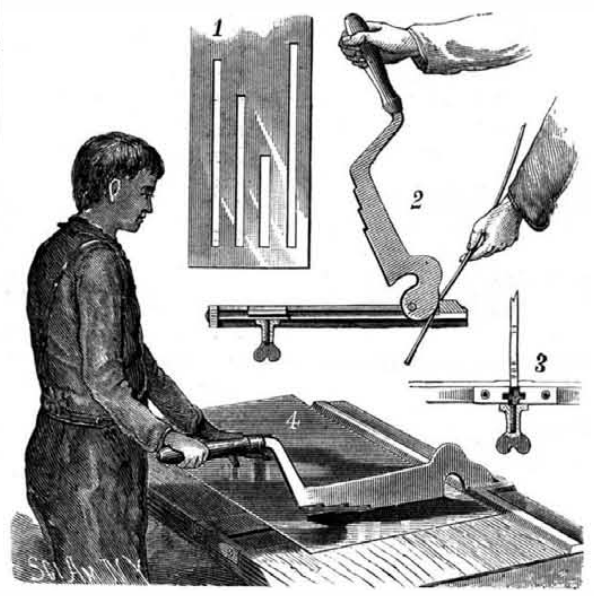
Transplanting Trees.

A writer in *Farm and Fireside*, in his directions respecting the treatment of trees before their removal, states as follows:

"A tree in full leaf may be compared to a powerful pump, the roots absorbing water from the soil, which is carried upward through the stem and exhaled from the leaves in the form of vapor. This exhalation from the leaves is really the primary operation, however, being simply a process of evaporation. If, now, the principal portions of the roots be cut away, and especially the fine rootlets which are farthest from the stem and through whose extremities nearly all the water is absorbed, the leaves, if allowed to grow, will exhaust the water from the stem and roots more rapidly than it can be supplied by the remnant of the latter, and the consequence will be the destruction of the tree. Hence, in transplanting trees the leaf bearing twigs should be cut away in proportion to the loss of roots, and it should be remembered that the root surface is generally equal to that of the twigs; consequently the safest rule is to remove nearly all the branches, trimming to bare poles. It is hard to do this, but the after-growth of the tree will be enough more rapid to compensate the apparent loss. In moving large trees it is an excellent plan to dig down and cut off a large portion of the roots a year before transplanting, removing a portion of the top at the same time. This will cause the formation of new rootlets near the stem, which may be preserved in the final transplanting."

SLOTTING SHEARS.

The slotting shears recently patented by Mr. Charles W. Crane, of Batavia, Iowa, are designed to cut slots in tin for any purpose. The shear blade is movable and is fitted to a stationary slotted die plate. The blade has a point near its pivoted end to punch through the tin to form one end of the slot, the sides of which are cut by the side edges of the shears. The slot will be limited by one of the series of ledges on the blade coming down in front of the end of a bit which is movable along the slot between the plates to be set for any ledge. The bit, shown in section in Fig. 3, has tongues running in grooves on the sides of the plates of the die. A single stroke of the blade, which is provided with a lever handle, will cut slots of different lengths. The sheet



CRANE'S SLOTTING SHEARS.

may be shifted sidewise to make slots wider than the blade. In order to sharpen the edges of the die plates and reset them closely to the blade, they are made separate and bolted to the table. By removing one of the die plates a straight cutter is formed. In Fig. 2 the device is shown adapted for cutting wire of all sizes. Fig. 1 shows a slotted sheet to indicate the work done by the shears. Fig. 4 shows the way of operating the shears. The apparatus is particularly applicable for making the slotted tin strips used in making the glass gauges for cream cans.

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India Ink.

A Chinaman named Chen-ki-souen has written a monograph on the famous Chinese ink, more commonly known here as India ink. We find the following interesting extracts, regarding its history and preparation, in the *Deutsche Industrie Zeitung*.

Many articles are found in the extensive literature of China written by their learned men about the paper, ink, and brushes that they use for writing, but unfortunately very little is said about the technology of their inks. It is quite otherwise in the recent book written by Chen-ki-souen, for he describes every stage of its preparation with great accuracy and in detail.

According to our Celestial author, a kind of pigment ink was discovered 2697 to 2597 B. C. It was employed for writing on silk with a bamboo rod. Afterward an ink was prepared from a certain stone (encre de pierre), which is still known in China as ché-hëi. It was not until 260 or 220 B. C. that they began to make an ink from soot or lampblack. The soot was obtained by burning gum lac and pine wood. This ink was made at first in round balls and very soon supplanted the stone ink.

For a while the province of Kiang-si appears to have had a monopoly of ink making. Under the dynasty of Tang, in 618 to 905 A. D., there was a special officer called an inspector, who had charge of its manufacture. He had to furnish the Chinese court with a certain quantity of this ink annually. Some of the factories seem to have been "royal Chinese" factories. The Emperor Hinan-Tsong (713 to 756 A. D.) founded two universities, to which he sent 336 balls of ink four times a year.

The most celebrated ink factory in China is that of Li-ting-kouëi, who lived in the latter part of the reign of Tang, and is said to have made an excellent article. He made his ink in the shape of a sword or staff, or in round cakes. The test of its authenticity consisted in breaking up the rod and putting the pieces in water; if it remained intact at the end of a month, it was genuine Li-ting-kouei. Since the death of this celebrated man there seems to have been no perceptible advance made in the manufacture of India ink.

In the manufacture of lampblack nearly everything is used that will burn. Besides pine wood we may mention petroleum, oils obtained from different plants, perfumed rice flour, bark of the pomegranate tree, rhinoceros horn, pearls, musk, etc. Nor does fraud seem to have been entirely wanting. According to Chinese authorities, the principal thing is the proper preparation of the lampblack; the best smells like musk, and the addition of musk not only serves to give poor goods the resemblance of fine ones, but really makes it worse.

The binding agent plays the chief part next to the lampblack; ordinary glue and isinglass alone are now used. In old times glue made from the horns of the rhinoceros and of deer was employed.

Good Chinese ink improves with age, and should not be used for a few years after it is made. It is not easy to keep it as it must be protected from moisture. Some persons, in rubbing it up, make circular movements that soon ruin it. It is better to rub it in straight lines back and forth with the least possible pressure.

FIRE ESCAPE.

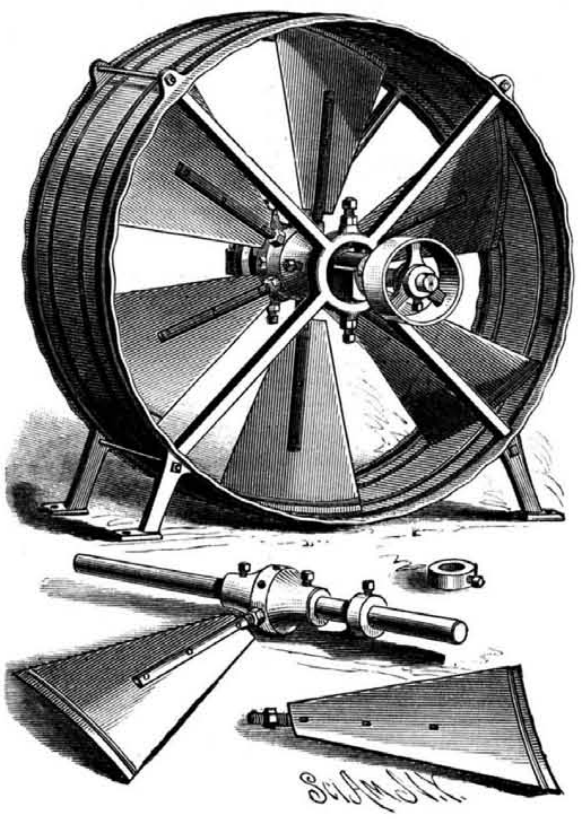
The fire escape herewith illustrated consists of balconies for each story, or for alternate stories, of a building, arranged on central pivots, on which they may be swung in such a way that the rising end of one will meet the lowering end of the next, thus forming a zigzag passage down which people may pass. Fig. 1 shows the balconies so arranged, the intermediate ones being permanently attached to the wall. The balconies are firmly bolted to the central shafts, which are square in the parts fitting the balconies, and which extend through the wall (Fig. 3), and are supported in bearing plates bolted to each side of the wall. Inside of the wall the pivots or shafts gear with a working lever by means of a toothed segment on each shaft and a vertical toothed bar gearing with the segments and also with the lever, as indicated in Fig. 4. The lever is located at the base of the wall, where it may be inclosed for its protection against fire. The vertical bar extends to the highest shaft, and is made in sections connected by swivels. The outer ends of the shafts have bearings in a long post diverging from the vertical line, in order that the rising end of one balcony will project beyond the falling end of the other, to provide safe transfer from one to the other. The balconies are made of sheet iron, with outwardly curved sides at their upper edges to deflect the flames, and are also made with double floors, between which the air will circulate, thus keeping the upper floor cool. Along the inside of the outer side plate of the balcony is a hand rail. The stationary balconies are made narrower than the others, so that persons may drop from one to the other without danger of falling to the ground. Fig 3 is a vertical section through the wall.

The invention has been recently patented by Mr. William S. Cassedy, of Kelly's Station, Pa., who should be addressed for further information.

THE French are experimenting with a new rifle, designed for infantry use, which is said to discharge three projectiles at a time.

A NEW DISK FAN OR EXHAUSTER.

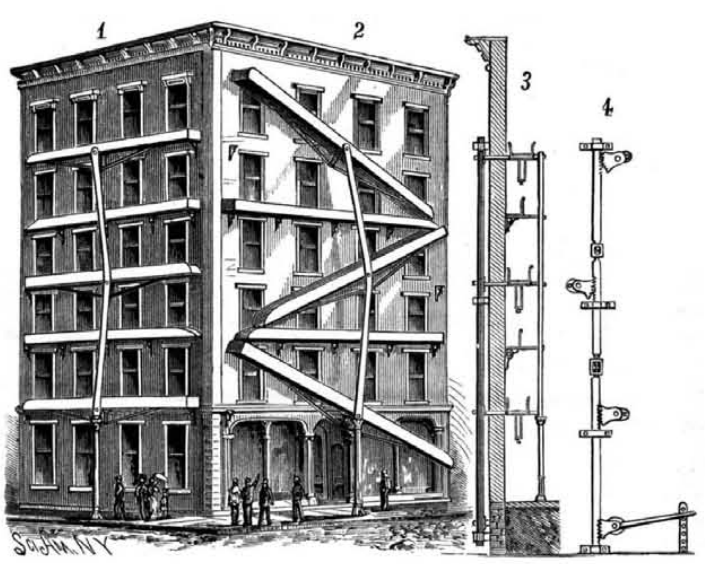
To economically move large quantities of air is a subject of great importance in many of the industries, and enters as one of the principal factors in the ventilation of large buildings. The accompanying engraving shows a fan of novel construction, which, although simple and of but few parts, may be readily and easily adjusted to suit conditions. The fan works on the principle of the screw propeller, and by a simple device the blades may be set at any pitch, so that the quantity of air moved may be varied to any point between the minimum and maximum capacity, and the same device enables the blades to be set so as to move the air in



NEW DISK FAN OR EXHAUSTER.

either direction. There are six curved blades made of sheet steel, having an increasing pitch augmenting the power and the amount of air moved. To each blade is riveted a heavy wrought iron arm having a thread cut upon the end, which screws into the hub and is set by means of a lock nut. This arrangement is indicated very plainly in the drawings of detached parts, representing the shaft, hub, and one blade in position, and the blade alone. The cast iron frames and sheet steel band make the "cut-off" in which the blades run, and cause a strong suction or force current. From the above it will be readily understood how the current can be changed in direction without disturbing either the belt or pipes. The shaft is in one piece, running in journals which are adjusted by two set screws, as shown. The fan may be fastened to the ceiling, the journals having been inverted.

The fan is noiseless in operation, and as the air is free to pass through the whole area, the current is much slower than in the usual forms, thus avoiding the unpleasant buzzing sound caused by air passing rapidly through small openings. When necessary a rapid current can be produced by reducing the size of the pipes. It can be put at either end or at the center of a pipe; in a wall or window, and will run equally well either horizontally or perpendicularly. A 48-inch fan now on exhibition at the American Institute Fair, running at about 450 revolutions a minute, draws through the small house to which it is attached the great amount of 26,175 cubic feet of air each minute. It is run with a 3-inch belt and uses 2 horse power. These fans were awarded the highest medal at the American Institute. The patentee, Mr. L. J. Wing, has perfected a plan of ventilating large edifices with the exhaust fan run by gas engines or other small motors. These fans are now being manufactured by the Simonds Manufacturing Company, of 50 Cliff Street, New York city, who have received many letters highly commending the fan and dwelling upon the large amount of air it moves, its lightness and simplicity, and the economy its use insures.



CASSEDY'S FIRE ESCAPE.

Mail Statistics of the World.

The statistics of the Universal Postal Union for the year 1881, published by the International Bureau at Berne, show that the United States anks first in number, with 45,512 offices, Great Britain being next with 14,918. Japan leads Russia, Austria, Italy, Spain, and British India. Switzerland ranks first in the relative proportion between the number of offices and the population, having an average of 985 inhabitants to each post office. In the number of letters carried Great Britain ranks first with 1,229,354,800; the United States next with 1,046,107,848; then Germany with 563,225,700. The Argentine Republic stands at the bottom of the list. The United States used the most postal cards. In respect to the number of letters and postal cards to each inhabitant, the countries ranked as follows: Great Britain. 38·7; United States, 27·3; Switzerland, 19·9; Germany, 15·8, The United States ranks first in the number of newspapers conveyed in the domestic mails with 852,180,792; Germany next with 439,089,900; France, 320,188,636; Great Britain, 140,789,100. Germany leads in respect to the gross amount of revenue with 205,324,215 francs; United States next with 194,630,444 francs; Great Britain third with 175,690,000 francs.

Coffee and Alcohol in Brazil.

According to the statement of the Vice Director of the Rio Janeiro faculty of medicine, it appears that in Brazil, where great quantities of coffee are used and where all the inhabitants take it many times a day, alcoholism is completely unknown; it is further stated that the immigrants arriving in that country, though beset with the passion for alcohol, contract little by little the habits of the Brazilians, acquiring their fondness for drinking coffee and their aversion for liquors; and as the children of these immigrants brought up with coffee from their early years never contract the fatal habits known to their parents, it would seem that the number of drunkards in the country is in inverse ratio to the amount of coffee consumed. A South American correspondent of the *Medical Times* confirms the above statements, asserting that the number of cafes in the large cities of Brazil—where multitudes of persons from the highest down to the lowest classes go in to take a cup of that delicious beverage which none but Brazilians know how to make properly—is enormous, while drinking saloons or bars are very few, and their patrons fewer still.

If the above is correct, our temperance advocates might take a useful hint. Less oratory and more coffee would give better success to their efforts. The opening of a cheap coffee house alongside of every gin mill might have the effect to dry up the liquor business.

Scarlet Fever in Horses.

For some time past scarlet fever among horses has attracted considerable attention, and committees from three medical societies are now investigating the subject. The disease was first described in horses, in 1514, and from that date to 1610 there are evidences showing its simultaneous appearance in both horses and men. The conclusion has been d awn by some writers that it originated in horses and was by them communicated to man. The New York *Sun* reports Dr. John C. Peters, chairman of each committee, as saying:

"The most remarkable results have been obtained by D. J. W. Steckler, of Orange, N. J. He had some equine virus sent to him by Dr. Williams, of Edinburgh. Dr. Steckler inoculated twelve children, who were afterward exposed to the disease of scarlet fever and did not take it. That was last May or June. He has inoculated two young colts and reproduced the disease among them. He failed with a calf, showing that the horses were more susceptible of the disease. Another set of children was inoculated, all of whom were living in the same room where a case of scarlet fever had broken out. Some who had been exposed before the inoculation took the disease, but a majority escaped. There was only one case that looked like failure. Dr. Steckler will cultivate the virus and prove his experiments. He is sure to meet with great opposition, and possibly as much as Jenner did, but I have no doubt he has made a discovery as great as Jenner's, and one that will prove as signal an epoch in the history of medicine."

Cleanliness in the stable, good ventilation, pure water, and reliable disinfectants, are the best preventives.

Percussion of the Skull as a Means of Diagnosis.

In the course of an article in the *Lancet*, Dr. A. Robertson tells us that in a case under his care, percussion of the skull revealed a painful area over the motor region of one side of the brain. The patient had long been subject to convulsive seizures, mainly unilateral, and has greatly improved since the application of a series of blisters over this region.

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THE GREAT CANTILEVER BRIDGE OVER NIAGARA RIVER.

(*Continued from first page.*)

of the floor beams; these stringers are plate girders 2½ feet deep. The track consists of 9 by 9-inch ties of white oak, spaced 18 inches between centers, every other tie projecting to support a plank walk and hand railing, making the width of the floor 32 feet. The guard timbers are 8 by 8 inches of white oak. The hand railing consists of cast iron posts, 6 feet apart, and four longitudinal lines of 1¼-inch gas piping.

All masonry is built of Queenstown limestone, in courses of 2 feet rise. The piers supporting the towers are 12 feet square under coping, and have a batter of one-half inch to the foot; each pair of piers is connected by a wall 3 feet 9 inches thick on top, and battering the same as the piers. These piers are on foundations made by excavating and blasting the rock on the banks of the river until a suitable bed was reached, consisting of layers of huge bowlders. The pits were filled with beton Coignet to a depth of about 8 feet, thereby forming beton blocks of 20 by 45 feet under each pair of piers.

The anchorage piers are 11 by 37½ feet under coping, with a batter of one-half inch to the foot. They rest on a platform consisting of twelve iron plate girders, 2½ feet deep and 36 feet long; under these girders are eighteen 15-inch I-beams, through which the anchorage rods pass in such a manner as to distribute the pressure over the entire mass of masonry. Each anchorage pier contains 460 cubic yards of masonry, weighing 2,000,000 pounds. As the maximum uplifting force from the cantilevers under the most unfavorable position of the load is only 678,000 pounds, it will be seen that this upward force is amply counterbalanced.

One of the most interesting features of this important work is the erection of the river arms of the cantilevers. After the towers were built the shore arms of the cantilevers were erected on false work in the usual way; after the shore arms had been placed in position and anchored down to the anchorage piers, the river arms were built out from the towers toward the river, one panel or section at a time, by means of great traveling derricks designed and constructed specially for the purpose and provided with steam power. After one panel had been built and its bracing adjusted, the traveler was moved forward and another panel erected. Thus the work progressed until the ends of the cantilevers were reached. The intermediate span of 120 feet was so designed, with bottom compression members, that it, too, could be built out from the river arms of the completed cantilevers until the middle panel was reached, which was accurately fitted to close the remaining gap between the two sides. The fixed connections between the intermediate span and the cantilevers were then removed to allow the expansion joints to act.

The structure is proportioned to carry, in addition to its own weight, a freight train on each track at the same time, weighing one ton per lineal foot, with each train headed by two 76-ton consolidation engines, with a factor of safety of 5. The wind bracing has been proportioned for a pressure of 30 pounds per square foot, on a surface twice the area of one face of the truss, plus area of floor system, plus the area of side of train taken as 10 feet vertical height.

The contract for the entire work, including foundations and masonry, was awarded to the Central Bridge Works, of Buffalo, N. Y., of which Gen. Geo. S. Field is the manager, and Edmund Hayes the engineer. The engineering force on the work was made up as follows: C. C. Schneider, chief engineer; A. R. Trew, first assistant engineer; J. A. Bell and B. F. Betts, assistant engineers; J. B. Trew, rodman; W. F. Zimmermann and Jacob Jung, inspectors; S. V. Ryland, superintendent of erection for the Central Bridge Works.

The engraving represents the bridge as seen from the American bank of the river, looking toward Niagara Falls, which can be seen under the center span.

Fireproof Rolling Stock for Railways.

It seems strange that we should hear the strongest advocacy of building railway cars of iron and steel from way out in Colorado, where, it is urged, the natural resources in coal and iron would enable such an industry to be prosecuted, even in competition with the work of Eastern rolling mills and machine shops. It is, however, only one of the many reminders constantly forcing themselves upon the attention of how great our country is and how wonderful are its resources. It is predicted that it will not be many years before Colorado will be "able to produce steel cheaper than any other State on the continent." But as yet, their soft coals are got out and marketed at a price which is some thirty-three per cent above that ruling at Pittsburg. Their ores may be of the most excellent description, and easily obtainable, but the coal also will have to come down, before our Western friends can look forward to doing a manufacturing business in the way of making iron and steel railway cars, although it is intimated, in this connection, that the Denver and Rio Grande Company intend ordering an experimental sleeper made entirely of steel plates and bars.

IN some of the large saw mills in the Northwestern lumber districts a small appliance is attached to the trimmer, which automatically stamps the name of the company or mill on every board that passes over the trimmer.

Manufacture of Straw Goods.

The *New York Hatter and Furrier* contains an article on the past and present manufacture of straw goods in America, from which it appears that the straw business as a manufacturing enterprise in America started with Fisher & Day, at Wrentham, Mass., in 1804.

Statistics give the number of bonnets made in 1837 as 4,000, with a value of $12,000. In 1845 the value of braid made in Milford was $12,500, while the value of bonnets produced had decreased to $1,500. In 1875, with only one manufactory, the capital invested had increased to $30,000, and the value of the goods to $190,000, employing in the production 16 males and 168 females. These figures are said to be much below the present plant and worth of goods, with three establishments, employing some 600 people, both male and female.

Relatively the same increase in the volume of business can be noted in other towns where the industry was started in the early days, and nearly all have contributed in a large degree to bring it up to its present condition as an important factor in industrial history. Twenty-five years ago, the following towns were credited with a production in straw goods valued as below:

Amherst	$32,000
Medfield	60,000
Mansfield	110,000
Medway	100,000
Franklin	405,000
Palmer	10,000
Munson	120,000
Middleboro	25,000
Upton	250,000

All in Massachusetts. Foxboro was producing 2,000,000 hats and bonnets, whose value is not given.

The civil war marked a new era in the making of straw goods, as it did in many other lines of industry. In 1870, the number of establishments in the United States was 75, with employes numbering over 14,000, all but about 2,000 being females; Massachusetts had 39 shops, employing 1,113 males, 10,000 females; New York, 18 shops, and 518 males and 886 females; Connecticut, 3 shops, with 225 males and 755 females. Since that time the business has grown in the places mentioned, and secured a firm footing in other localities, especially in Philadelphia, Baltimore, Chicago, Milwaukee, and the State of New Jersey. There are very few of the places noted as pioneers in the manufacture of straw goods that do not carry it on to-day, Medway, Mass., being an exception. Holliston, Framingham, and Westboro, Mass., are places not mentioned above, where, especially in the two latter, straw serves as a large and important item in the enterprise and general prosperity.

The output from the New England shops last year is set down at 14,000,000 hats, and from factories west of New England nearly as much more, making in all from 25,000,000 to 30,000,000 hats as the annual production of the country. This, with the large number of hats made over in the repair shops, gives a supply probably equal to a straw hat for every individual in the United States. In the estimates above, however, the velvets and felts which some of the shops make for ladies' wear are included, but men's, except straws, are not taken into account.

Spider Life Wonders.

In a lecture at the Lowell Institute, Professor Wood dealt with the phenomena of spider life. The female is larger and much fiercer than the male, who while paying his addresses is in constant peril, frequently losing some of his legs. In one tribe the female is 1,300 times as large as the male. The spider's thread is made up of innumerable small threads or fibers, one of these threads being estimated to be one two-millionth of a hair in thickness. Three kinds of thread are spun: One of great strength for the radiating or spoke lines of the web. The cross lines, or what a sailor might call the ratlines, are finer and are tenacious, that is, they have upon them little specks or globules of a very sticky gum. These specks are put on with even interspaces. They are set quite thickly along the line, and are what, in the first instance, catch and hold the legs or wings of the fly. Once caught in this fashion the prey is held secure by threads flung over it somewhat in the manner of a lasso. The third kind of silk is that which the spider throws out in a mass or flood, by which it suddenly envelops any prey of which it is somewhat afraid, as, for example, a wasp. A scientific experimenter once drew out from the body of a single spider 3,480 yards of thread or spider silk—a length a little short of three miles. Silk may be woven of spider's thread, and it is more glossy and brilliant than that of the silk worm, being of a golden color. An enthusiastic entomologist secured enough of it for the weaving of a suit of clothes for Louis XIV.

Top Dressing for Lawn.

Instead of top dressing a lawn with stable manure every fall, and then raking it off in the spring, as is the usual custom, writes a correspondent, try sowing broadcast in the fall 300 pounds to the acre of finely ground raw bone meal and an equal weight of refuse salt from the pork or beef packing establishments, and 150 pounds of gypsum (land plaster). Then scatter on the surface at least half an inch of good, rich, black soil, sow at the rate of two bushels of blue grass seed to the acre, and give it a thorough raking and then roll it, and you will have no further trouble with your lawn, no matter how dry the seasons may be.

A Seventh Sense.

Sir William Thomson, the eminent Professor of Mathematics in the University of Glasgow, in his inaugural address as President of the Midland Institute at Birmingham, broached the idea of the existence of a magnetic sense. This sense he called the seventh sense, to distinguish it from our other six senses—namely, those of sight, hearing, taste, smell, heat, and force. He said that, in speaking of a possible magnetic sense, he in no way supported that wretched, groveling superstition of animal magnetism, spiritualism, mesmerism, or clairvoyance, of which they had heard so much. There was no seventh sense of a mystic kind. Clairvoyance and so on was the result of bad observation chiefly, somewhat mixed up with the effects of willful imposture, acting on an innocent and trusting mind.

If there was not a distinct magnetic sense, it was a very great wonder that there was not. The study of magnetism was a very recondite subject. One very wonderful discovery that was made in electric magnetism was made by Faraday, and worked out very admirably by Foucauld, an excellent French experimenter, showing that a piece of copper, or a piece of silver, let fall between the poles of a magnet, would fall down slowly, as if through mud. Was it conceivable that, if a piece of copper could scarcely move through the air between the poles of an electric magnet, that a human being or living creature, in the same position, would experience no effect? Lord Lindsay got an enormous magnet, so large that the head of any person wishing to try the experiment could get well between the poles; and the result of the experiment was marvelous, the marvel being that nothing was perceived.

Sir William Thomson, however, was not willing to admit that the investigation was completed. He could not but think the quality of matter in the air, which produced such a prodigious effect on a piece of metal, could be absolutely without any perceptible effect whatever on a living body. He thought the experiment was worth repeating; and it was worth examining whether or not an exceedingly powerful magnetic force was without perceptible effect on a living vegetable or animal body. His own speculations had led him to conclude that there might be a seventh or magnetic sense; and that it was possible an exceedingly powerful magnetic effect might be produced on living bodies that could not be explained by heat, force, or any other sensation.—*British Medical Journal.*

Burdette's Lectures to Young Men.

Robert J. Burdette, the facetious editor of the Burlington *Hawkeye*, has been lecturing to large audiences in different parts of the country, and in his amusing style he imparts to the rising generation some wholesome advice. The following is from one of his lectures:

"Be somebody on your own account, my son, and don't try to get along on the reputation of your ancestors. Nobody knows and nobody cares who Adam's grandfather was, and there is not a man living who can tell the name of Brigham Young's mother-in-law." The lecturer urged upon his hearers the necessity of keeping up with the every-day procession, and not pulling back in the harness. Hard work never was known to kill men; it was the fun that men had in the intervals that killed them. The fact was, most people had yet to learn what fun really was. A man might go to Europe and spend a million dollars, and then recall the fact that he had a great deal more fun at a picnic twenty years ago that cost him just 65 cents. The theory that the world owed every man a living was false. The world owed a man nothing. There was a living in the world for every man, however, providing the man was willing to work for it. If he did not work for it, somebody else would earn it and the lazy man "would get left." There were greater opportunities for workers out West than in the Eastern cities, but men who went out West to grow up with the country must do their own growing. There was no browsing allowed in the vigorous West. An energetic man might go out into the far West, and in two or three years possess himself of a bigger house, a bigger yard, a bigger barn, and a bigger mortgage than he could obtain by ten years' work in the East. All young men ought to marry, and no young men should envy old men or rich men. In conclusion, Mr. Burdette said that a man should do well whatever he was given to do, and not despise drudgery. The world wants good shovelers, teamsters, and laborers, but it does not want poor lawyers, poor preachers, or poor editors.

A New Method of Obtaining Pulp.

G. Archbold macerates wood or straw, cut into suitable pieces, in dilute milk of lime, after twelve hours introduces them into a suitable digester, and saturates with sulphurous acid, the pressure amounting to four or five atmospheres. In two hours the material is so loosened up, that after washing with water and further treatment under pressure with 3 per cent chloride of calcium and half per cent aluminum sulphate dissolved in a little water, the stuff obtained without any further operation has the appearance of cotton, and can serve for the manufacture of fine qualities of paper.

RECENTLY some valuable experiments in photographing the larynx and soft palate at the instant of singing have been made. A powerful electric light was thrown into the throat, the subject then sang a note, and the actual position of the vocal ligaments, uvula, etc., was photographed instantaneously.

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Petroleum—How Obtained and Piped.

An interesting pamphlet, entitled "Manual of Petroleum," published by the Financial News Association, in this city, gives the following:

The petroleum bearing rock is a sandstone existing in irregular shape, whose extent and form are found only by experimental boring. This rock lies on a level, and is from 5 to 30 feet thick, varying in the different fields. The depth to which a boring has to be made to reach it depends on the topography of the overlying country. The deepest wells are in the Bradford, which is the largest field. Some wells there are over 2,000 feet deep, while about Oil Creek they do not penetrate to more than a third of this depth. The earlier theories were that petroleum existed in crevices or fissures of the underlying rock, but it is now established that it permeates the entire bed of sandstone, the forcing power for the flowing well being furnished by the pressure of gas. After the well has been flowing a considerable time this pressure diminishes, and with the final escape of the gas pumping has to be resorted to. No one can attempt to predict how long a well will last, nor how soon it will give out. Some wells have been pumped for years, and others have failed entirely within a few weeks, and the quantity of oil afforded varies from less than a barrel to over 4,000 barrels a day.

HOW THEY GET OIL.

In boring for oil a wooden derrick of plank and boards is erected. It is usually 20 feet square at the base, 60 to 70 feet high, with the corners so arranged that the top is about 3 feet square. Here rests a heavy piece which holds the pulley over which the 2-inch drilling cable works. In the less elevated localities it is necessary to drive pipe to prevent the caving in of the well and the influx of water. This pipe is of wrought iron, 8 inches in diameter, and is driven in 17 foot sections by a heavy maul erected in the derrick. Since it is to guide the drilling tools, great care is taken to keep it straight. The engine, usually of 15 horse power, is placed near the derrick, 12 feet from the center of which is placed the "Samson" post, a heavy piece of timber, 20 inches square and 12 feet high, the top of which is prepared to receive the walking beam. This beam tapers slightly each way from the center. It is about 15 inches square, and of such a length that when properly balanced on the "Samson" post one end is over the middle of the derrick floor. To this end is fastened the cable and drilling tools, which weigh some 3,000 pounds, and the other end derives power from the engine, giving the beam a rocking motion, which lifts and drops the tools. They are lowered and drawn by the aid of the "bull" wheel and shaft.

An 8-inch hole is drilled below the veins of fresh water, which are shut off by a wrought iron casing tube, 5½ inches in diameter, lowered in sections 18 feet long. After the necessary length of casing is introduced, the size of the hole is lessened to 5½ inches, and this size continues down till the well is completed. After oil is struck the tubing pipe, of 2 or 2½ inches diameter, is let down inside the casing, and a seed bag dropped in between the tube and the casing. This bag is of leather and is filled with flax seed. When it becomes saturated with water it swells and makes a water-tight joint, so that no water can get below it. Four men, two drillers and two blacksmiths, are required to sink a well, and the cost runs from 75 cents to $1.50 per foot. The rock, pulverized by the blows of the drill, is removed by use of the sand pump. This is a heavy metal tube, 6 feet long, which is rapidly lowered with every 6 feet of progress, the drilling tools being first withdrawn. The sand pump has a valve in the lower part, which closes and retains the contents until the surface is reached.

TORPEDOING A WELL.

The process of "torpedoing" a well is resorted to when the well shows signs of giving out. A tin shell filled with a couple of gallons of nitro-glycerine is dropped down and exploded, bursting the rock at the bottom. The effect of this is generally to at once largely increase the yield for the time being.

THE PIPE LINES.

The storage and transportation of petroleum is in the hands of two companies, whose pipes cover the entire field of Pennsylvania, and convey it to reservoirs hundreds of miles distant. The largest of these companies, the United Pipe Lines, is controlled by the Standard Oil Company. These lines are six in number; two run from Olean to Communipaw, on New York Bay; another runs to Buffalo, one to Cleveland, one to Pittsburg, and the sixth to Milton Station, on the Reading road. Its pipes, in the aggregate, are over 3,000 miles long, and its owns over 600 tanks with an aggregate storage capacity of 20,000,000 barrels. The nucleus of this great system existed prior to 1876, when there were several short lines under different organizations. Between 1876 and 1879 they were all absorbed by the Standard Oil Company.

The other company is the Tidewater Pipe Line Company, controlled by Messrs. F. B. Gowen and James R. Keene, which connects the Bradford field with Tamanend Station, on the Reading Railroad. This was started in 1879, and altogether handles but about one-seventeenth of the business transacted by the United Pipe Lines.

The Pipe Lines not only connect the various fields with the market points, but also the fields with each other.

In dealing with the producer the Pipe Lines send a man to the well when the tank there is full. With his measuring rod he takes a gauge of the oil in the tank, and runs the oil off into the connecting arm of the Pipe Line by means of a stop cock. When he finishes, he measures the depth of the oil that still remains in the tank, and makes out a certificate, giving the depth of the oil in the tank at the beginning of the run, and its depth after running off the oil. One copy of his certificate is given to the producer and another is sent to the head office of the Pipe Lines. The books are kept there, and an entry is at once made, giving the producer credit for just the number of barrels run off, less three per cent deducted for waste.

The producer receives certificates in lots of 1,000 barrels each for just what oil he is entitled to, which are good anywhere for just that much oil, or its value, save that when a holder wants the oil it represents delivered, he is required to pay twenty cents a barrel for pipage and a further charge of fifty cents per 1,000 barrels per day for storage. No storage charge is, however, made against the producer for the first thirty days. These certificates are subject to a double storage charge if not returned to the company for renewal within six months of their date.

It is not to be supposed that the Pipe Lines stand the loss which occurs when a tank takes fire. This loss is assessed on all the oil in store, each holder of an acceptance being taxed his share. The loss from this source is, however, very trifling.

The Pipe Lines convey the bulk of the oil to terminal points, but not all. A considerable quantity is conveyed by pipe to convenient stations, and then shipped by rail in the oil tank cars so familiar to the sight and olfactories of the tourist.

The Pipe Lines work by gravity where that is possible; and where it is not, pumping engines are set up and the oil is forced through the pipes.

The oil that is carried by the Pipe Lines is crude petroleum. The refining necessary to fit the oil for its commercial uses is done principally at Cleveland, Buffalo, Oil City, Pittsburg, and in the vicinity of New York city. The bulk of the petroleum exported is refined oil.

The Corn Crop.

A Milwaukee grain dealer has just published an estimate on the yield of corn this year, compiled from official returns and other reliable sources of information, from which it appears that the total crop slightly exceeds that of last year, and is the largest ever raised in the United States, excepting 1880. The total amount this year is put at 1,621,100,000 bushels. The United States Department of Agriculture, in its October report, placed it at 1,617,025,100 bushels, or only a little over three millions less than the Milwaukee estimate. The total crop of 1880 was 1,717,435,000 bushels, or 96,435,000 more than this year's. Following is the tabular statement of yield by States:

State.	Bushels.	State.	Bushels.
Maine	800,000	Arkansas	34,000,000
New Hampshire	800,000	Tennessee	75,000,000
Vermont	1,800,000	West Virginia	15,000,000
Massachusetts	1,200,000	Kentucky	75,000,000
Rhode Island	300,000	Ohio	70,000,000
Connecticut	1,200,000	Michigan	25,000,000
New York	20,000,000	Indiana	100,000,000
New Jersey	10,000,000	Illinois	170,000,000
Pennsylvania	40,000,000	Wisconsin	25,000,000
Delaware	4,000,000	Minnesota	20,000,000
Maryland	16,000,000	Iowa	165,000,000
Virginia	35,000,000	Missouri	190,000,000
North Carolina	35,000,000	Kansas	190,000,000
South Carolina	15,000,000	Nebraska	90,000,000
Georgia	36,000,000	California	3,000,000
Florida	4,000,000	Dakota	6,000,000
Alabama	32,000,000	Other States and Territories	5,000,000
Mississippi	30,000,000		
Louisiana	15,000,000		
Texas	65,000,000	Total	1,621,100,000

How Stumps are Blasted Out.

A correspondent of the Ohio *Farmer* gives his experience and some practical directions on this subject, as follows:

"Last spring I sent to Indiana and hired a man to come and blast out stumps. I paid 42½ cents per pound for the powder, and 15 cents for each stump taken out—he to furnish caps and fuse. The stumps were mostly white and burr oak, from 20 to 40 inches in diameter, and had been cut from six to twelve years. Sixty-seven of the worst were taken out at an expense of 68 cents per stump. There were only three or four failures in the whole lot. As they were blown into pieces, it was much less work to pile and burn them than when taken out in the ordinary way. "I bought material and took out nearly 200 smaller stumps at an expense of about 20 cents each. It took me about ten or fifteen minutes to prepare a blast. I used a two-inch auger on a five-foot shaft for boring under the stump. A crow bar will do in soft ground; those who follow the business use a two and a half inch auger. The charge should be put as nearly under the center of the stump as possible.

"It is not very dangerous to use, as fire will not explode it. The cap is placed in the cartridge, and is connected by a fuse. You light the fuse, which in one or two minutes explodes the cap. The concussion of the cap, which is equal to 500 pounds, explodes the dynamite or Hercules powder. Eight or ten rods is a safe distance if you are facing the stump, or you can easily dodge chunks if any come toward you.

"It will not pay to use it very extensively on green stumps, as it will take from three to eight pounds per stump, and will not give very good satisfaction at that."

The Shoeing of Horses.

At the recent meeting of the American Street Railway Association, the following was reported on the above subject. The hoof of the horse in its natural state is adapted only to the soft and yielding soil; and so when we wish to put them to practical use upon common roads and paved streets, it becomes necessary to protect the foot from the unnatural wear they become subjected to. The practice of protecting the hoof in some manner dates back for centuries, and from the rude devices then used we have come down to the present day, in which many forms of shoes are made, all of which have their claims to superiority.

In selecting the shoe the kind of foot should be considered; but as a rule, in our judgment, a flat shoe that will leave the foot in the most natural state, allowing the frog to receive a portion of the weight or blow, is preferable, particularly for the forward foot; the natural formation of the frog being of a soft, spongy growth with elastic properties, would seem to be made for that purpose.

As a rule, horses coming fresh from the pasture have sound and healthy feet with broad frogs, and we should so adapt the shoe as to retain the natural formation as near as possible.

Too much care cannot be used in preparing the foot for the shoe. The frog should never be cut; the shell requires more or less cutting. The shoe should always be fitted to the foot and not the foot to the shoe, as is often done.

Corns, the most prevailing disease we have to contend with, appear in the angle of the foot near the heel; and are caused by the shoe not being concaved enough, or allowing them to remain on long enough for the shoe to become embedded into the heel, and often is the result of unskillful shoeing.

Moisture we believe to be essential to the preservation of the foot. The railroad horse stands on the floor about twenty hours of the twenty-four, and consequently the feet get very dry; therefore we would recommend the application of water frequently, not only to supply the natural moisture, but for cleanliness.

In shoeing the horse the workman should bear in mind that he is protecting the foot from the unnatural wear, and that it is only for that purpose; therefore all prejudice as to opinions of how it should be done should be laid aside. The horse commences life with sound feet, but too many of them are ruined by unskillful shoeing, and thus brought to comparative uselessness at a time of life when they should be in the prime of their power.

The Health of the Army.

According to the report of the Surgeon-General of the Army for the year ending June 30, 1883, the diseases of the respiratory organs stand first in numerical importance, and of these 64 per cent are catarrhs of the upper air passages. Extremes of variation in temperature will account in part for the frequency of these diseases, but to a larger extent insufficient ventilation of barracks and dormitories, as well as irregular and unequal distribution of artificial heat during cold weather, must be held responsible. Wounds, injuries, and accidents stand second on the list of causes impairing the effectiveness of the army. The large number recorded in this class may probably be attributed to the use of troops in mechanical and laborious employments which form so large a proportion of the soldier's duties. As an indication of the peculiar hardships to which our troops are exposed, the rates of admission for wounds, accidents, and injuries are 122 per thousand higher than those reported for the German army, and 142 per thousand higher than the decennial rate of the British army. It is interesting to note that the colored troops make a particularly favorable showing in the small number of admissions for alcoholism and its results, exhibiting, as they do, a rate of only 4 per thousand to a rate of 76 per thousand of mean strength among the whites. On the other hand, in diseases of the nervous system they have an unexplained preponderance.

The Origin of Cholera.

A correspondent thus writes to the *Brit. Med. Jour.*, October 6, 1883:

"I have no work to refer to, but, if I remember rightly, butyric acid, when taken internally, produces symptoms like cholera; and the acid is formed when dead animal matter is left for some time in water. If this be right, then, as the Ganges and the Nile have presented the conditions favorable for the formation of the acid, may not some of the cholera near both rivers be accounted for? A great outbreak of cholera occurred in Shanghai in 1863, after the Taeping rebellion, and when the rivers contained numerous dead bodies."

Hot Water for Colds.

Dr. George R. Shepherd, Hartford, Conn, says, in respect to the use of hot water as a remedial agent in the treatment of inflammation of the mucous membranes, "I have used hot water as a gargle for the past six or eight years. In acute pharyngitis and tonsillitis, and in coryza, or cold in the head, if properly used in the commencement of the attack, it constitutes one of our most effective remedies, being frequently promptly curative. To be of service it should be used in considerable quantity (a half pint or a pint at a time), and just as hot as the throat will tolerate. I have seen many cases of acute disease thus aborted, and can commend the method with great confidence."

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A Grand Observatory on the Mediterranean.

The readers of the SCIENTIFIC AMERICAN SUPPLEMENT will remember that some time ago (No. 327) appeared an illustration and description of a new observatory that was in process of construction at Nice, France, by a wealthy Continental banker. The London *Times* has recently published a more detailed account of this observatory, from which we extract as follows: One of the finest observatories in Europe is now almost completed at Nice, and the work of observation has already commenced, under the able direction of M. Perrotin, the French astronomer who conducted the expedition to Patagonia for the observation of the Transit of Venus. The importance of this new undertaking may be judged of from the fact that more than £80,000 has already been spent upon it, and the total cost, when all is complete, will not fall far short of £120,000. This great enterprise is due entirely to the munificence of M. Bischoffsheim, of Paris. France, it is well known, has fallen somewhat behind the age in the matter of astronomical observatories, whether public or private.

In England, America, Russia, and other countries they are far more numerous than in France; and the establishment of the observatory at Nice is consequently considered a patriotic work which will help to redeem the reputation of France in the world of science. The site is admirably selected on the crest of a hill to the east of Nice, dominating the Valley of St. Roch, and commanding a magnificent panoramic view of the entire town, the basin of the Paillon, and the innumerable mountains that rise on either side to shelter the flower gardens and the orange and olive groves that lie at their feet. The central building is the library, a capacious and luxuriously furnished hall, with sweet scented pine wood shelves, bearing the literature in all languages devoted to the one subject of study; while the walls outside are decorated with handsome mosaics, inscribed with the names of Laplace, Arago, and Leverrier.

On both sides of the library are the houses of the astronomers, distinguished by elegance and comfort. In the Director's office telephonic communications connect every part of the establishment. The two largest instruments are the great and the small equatorial, each, of course, placed in a building of its own, with a revolving cupola roof. The smaller of these telescopes is now in working order. It measures 7 meters in length, and the objective 18·38 centimeters in diameter. Both the body and the lenses were made in Paris. The cupola of wood and copper opens and shuts and revolves with the greatest ease, one man alone sufficing to set the whole of this large dome in motion, and this without any fatiguing effort. The larger equatorial telescope will cost for the instrument alone £14,000. This monster, which can only be compared to a 100 ton gun, is 18 meters in length, and the diameter of the object glass is 76 centimeters; yet it can be moved with the slightest touch of the hand and follows with ease every movement of the planets. When in working order it will be one of the sights of Europe. Until the telescope now projected for the Observatory of Pultawa at St. Petersburg is completed, it may be considered, we are assured, the finest instrument of its kind. The building destined to hold this giant is a formidable quadrangle of Turbiæ stone, and though the heights of Turbiæ are within sight of the observatory, and but a few miles away, the mere stones required for the wall around this telescope cost £6,000. Altogether, this one telescope, the cupola through which it can command the sky, and the building it occupies will cost about £40,000. The town of Nice can now boast of an institution that will render its name as familiar among astronomers as it is to those who study the climatic treatment of disease.

LOCOMOTIVE ELECTRIC LIGHTS.

In our paper for November 10, we gave illustrations of a traction engine carrying an electric machine for generating light and a tower for the use of the light. We herewith illustrate another special application of the electric light in its use upon railroad trains for brightly lighting up the road ahead of the locomotive. Upon certain lines, on which the track may become easily obstructed, such a light is of great importance, and is capable of rendering great services.

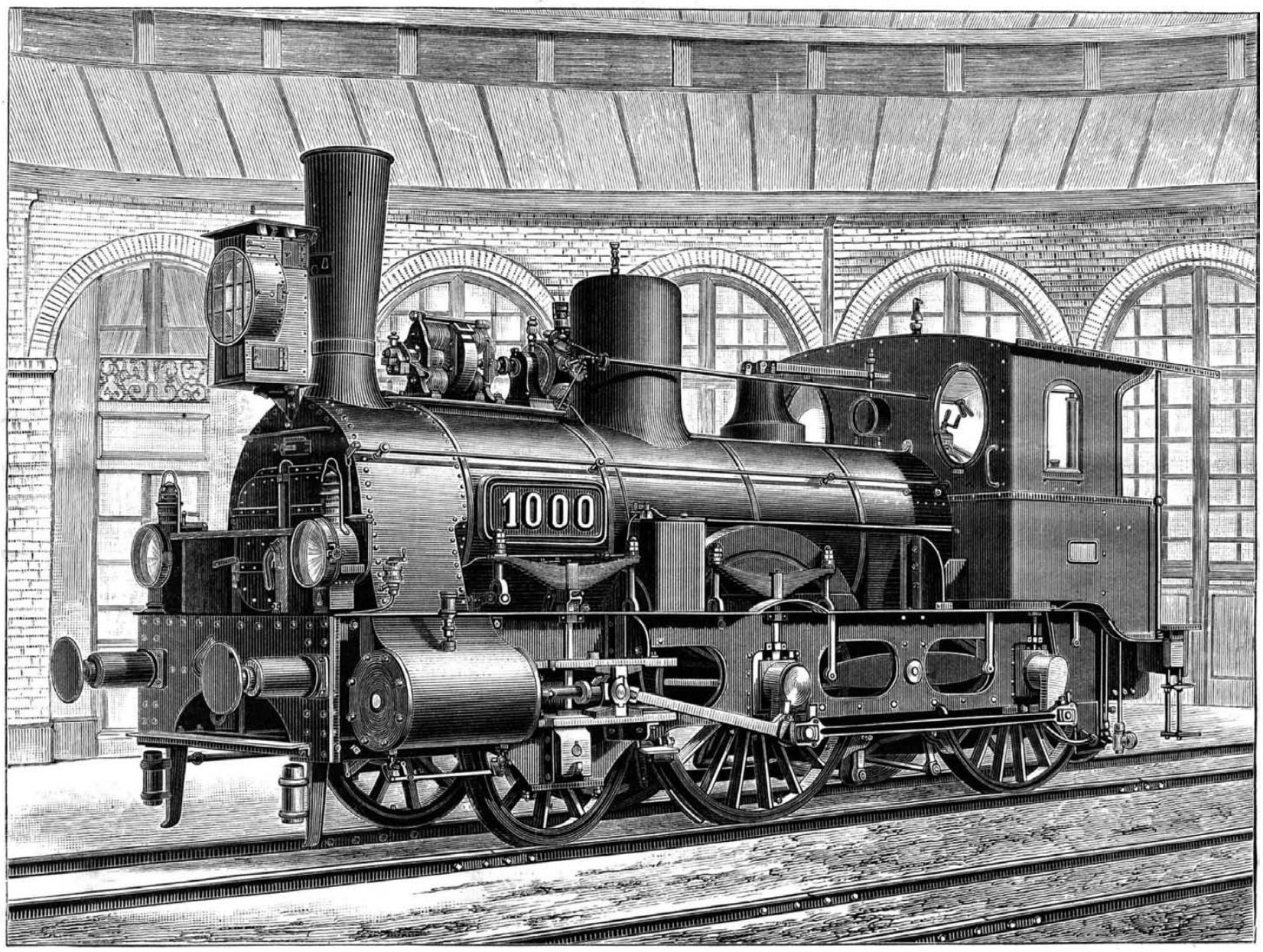
In order to permit of the adaptation of the electric light to a locomotive it has been found necessary to have recourse to a regulator of special construction, and one capable of operating well while submitted to the jarring that attends such an engine.

The regulator of Messrs. Sedlaczek & Wilkulill is of this nature. It has been derived from an apparatus, now old, constructed in 1856 by Messrs. Lacassagne & Thiers.

In this lamp, which we have heretofore illustrated, the upper carbon being fixed, the lower one was pushed into a tube by a column of mercury that rose slightly every time the arc became too large.

The entrance of mercury into the tube that carried the lower carbon was regulated by the current itself in the following way: The slightly elevated reservoir that contained the mercury communicated with the carbon holder tube through a rubber tube that was held between the core of an electro-magnet and its armature. This electro was traversed by the current from the lamp, and, as long as the intensity was normal, its attraction upon its armature kept the rubber tube closed and prevented the mercury from flowing. But when the arc elongated the armature fell, and the mercury pushed the carbon up until the former intensity was established again.

Our illustration, which is from *La Lumière Electrique*, shows a locomotive with the dynamo machine arranged just back of the smokestack. By a lever extending to the cab the engineer starts or stops the electric machine, and so lets on or shuts off the head lights.



LOCOMOTIVE WITH ELECTRIC HEAD LIGHTS AND ELECTRIC MACHINE.

A Curious Electric Phenomenon.

On his ground at Espeluy, Count De Las has a locomotive that runs a thrashing machine. While standing near the belt and holding over him an umbrella to shield himself from the sun, the Count chanced to touch one of the iron braces that supported the ribs of the umbrella, and suddenly felt a very perceptible spark upon his hand. On the following day, he says, I repeated the experiment, and obtained at two centimeters' distance very frequent sparks that formed an almost continuous current, whose intensity increased with the rapidity of the motion.

When the rapidity of the engine was great there was heard a crackling of strong sparks which were leaping from the belt to the boiler, although we could not see them on account of the strong sunlight in the middle of the field. How is this phenomenon to be explained? Could it be attributed to the development of electricity obtained by evaporation, which was the basis of the Armstrong electric machine? No, because the boiler of this machine must be mounted upon large insulated columns. Here, on the contrary, the locomotive, through its iron wheels, communicated directly with the earth, and the latter, which was certainly quite moist, increased its conductivity. The explanation that appears probable to me is the following: The belt was not sufficiently taut, and, in order to increase its adherence to the rim of the fly wheel, it was thickly besprinkled with resin. But, despite all this, the adherence was not perfect; there was friction between it and the fly wheel, and, in this rotary friction, just as happens in the electrophorus, the two fluids separated. The metallic frame work of the umbrella operated as a condenser, and, since the belt was 10 meters in length and 20 centimeters in width, it presented a superficies of 2 square meters, upon which a large quantity of free fluid was capable of accumulating. I had not, upon the spot, a means of verifying the kind of electricity, but I think that I can assert that it was resinous.—*J. M. Folache, in La Nature.*

[The "phenomenon" would seem *curious* only to those who do not know about the electricity of machine belts; belt electricity is within the experience of most mechanics, and nothing beyond the ordinary appears to have occurred in the Count De Las' case. Also the allusion to Armstrong's machine and the electrophorus indicates that J. M. F. is not a very competent witness on electrical matters.—EDS. SCIENTIFIC AMERICAN.]

THE Treasurer of the immense colony of South Australia says that the population is only 300,000.

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THE CANADIAN PORCUPINE.

From time immemorial the belief has existed that the porcupine can project its quills through the air like arrows at an enemy, and beyond this the popular mind is yet more in error as regards the structure and habits of this aberrant and curious mammal. Let us therefore consider some of the more prominent points in its life history.

The female porcupine during the last of April or the first of May builds a rough nest in some hollow tree or rock fissure, and there brings forth usually two, sometimes three, young ones. The mother is exceedingly shy until the young are weaned, and but few observations have been made upon them during the period of suckling; probably like all rodents they mature very rapidly and are soon able to shift for themselves. This species is one of the slowest and most clumsy of quadrupeds; safe in its protective armor, it seldom makes much effort to escape when surprised on the ground, but placing its muzzle between its fore legs, erecting its spines, and whisking rapidly its short tail, waits on the defensive—and even the panther and formidable grizzly bear are obliged to retreat from this fine array of bayonets.

The spines vary much in size and shape, varying from the coarse brown hair with which they are mingled to strong three inch spikes one-eighth of an inch in diameter. Their bases are white and the points dark brown, the latter portion well provided with sharp, recurved barbs. Being but loosely rooted in the skin, when roughly touched the points penetrate, the barb holds fast, and the quill comes off attached to the offending body; doubtless from this arose the fable that the animal can *shoot* its quills. When the sharp spines once penetrate the skin of an animal, owing to the peculiar set of the barbs the muscular movements of the wounded part cause them to work their way inward, and a very serious wound is finally the result. Panthers, wolves, and wildcats have frequently been found dead with hundreds of quills embedded in their fore feet and mouths, thus proving fatal. Dogs are also frequently killed and injured, and in consequence the porcupine is hated and always mercilessly killed by hunters whenever found. The food of the hedgehog—as the porcupine is almost universally called by woodsmen—consists of the inner bark, and at times the leaves of trees. When pressed by hunger it will devour the bark of almost any species, but the hemlock and spruce seem to constitute its favorite food. The young and succulent trees are usually the ones selected, and the animal seldom leaves one until it has been entirely stripped of its bark. But the porcupine seems to be almost omnivorous, for in captivity it will eat almost any vegetable substance. In the Adirondack wilderness—where this species abounds—they are frequent visitors at deserted camps, trying their powerful incisor teeth on all that comes in their way. It is exceedingly unsafe to leave one of the light cedar canoes there used anywhere in the woods unguarded for a day or two, for the hedgehog seems to have a decided liking for oil paint and varnish, and will cut down the entire side of a boat in a very few days; I have seen many boats so rendered useless. As may be imagined, they are not much beloved by the guides, among whom "the d—d hedgehogs" is a favorite topic on which to *let off steam* when a boat leaks.

As already suggested, the porcupine is a capital tree climber, its strong hand-like fore feet and long claws being perfectly adapted for the purpose. It uses these paws to hold food when eating, sitting on its haunches in the manner of a squirrel.

It does not hibernate, but remains active during the winter, clearing the snow away from the tree branches and living entirely on their bark. At times it forms a den in a hollow tree near its feeding grounds, in which to pass the night.

The porcupine quill work of the Indians—the quills being stained various colors—is too well known to need description; its flesh is also eaten by both whites and Indians, and is said to resemble pork.

This species becomes very tame and gentle in confinement, readily learning to take food from the hand, and never elevating its quills when stroked or taken in the arms of those who are kind to it.

The Canada porcupine (the *Erethizon dorsatus* of zoologists) scarce needs any description; a short, heavily built animal, thirty-eight inches in entire length, with a short tail, huge yellow incisor rodent teeth, two above and two below, the skin provided with a thick mat of erectile spines, are sufficiently prominent characters to identify the animal at a single glance.

The genus *Erethizon* presents many interesting details of structure; as is the case in the beaver, the molar teeth resemble in structure those of the horse, being formed of complex infoldings of dentine bounded with enamel and the valleys between filled with cementum—the best arrangement imaginable for grinding thoroughly its coarse and fibrous food. It is exceedingly interesting that the beaver, feeding on the same substances, should present the same tooth structure.

THE CANADIAN PORCUPINE.

The infraorbital foramen—in most mammals of very small size and transmitting only the infraorbital nerve and blood-vessels—is of enormous size, and through it passes the great muscle which closes the lower jaw—the masseter; by this arrangement great leverage and strength is given to the inferior jaw.

A porcupine found in Java shows the curious anomaly of a tongue provided with tough, horny plates, but this is not the case with the American representative of the genus. The right lung of the *Erethizon* is stated to be twice the size of the left, but my own dissections would not put the limit at more than one-third larger.

The whole muscular system is exceedingly well developed, and the skin is well supplied with powerful special muscles to erect the spines.

The Canada porcupine is essentially a northern animal, seldom being found as far south as Virginia. A western variety is said to be found as far south as Mexico, but only, I believe, on high plateaus of temperate climate. It has been found as far north as latitude 67°. In the North Woods of New York State, as already stated, I have found it abundant; a few yet remain in the wildest portions of Pennsylvania; but this is one of the many animals doomed to rapid extinction, and every year it becomes rarer.

RALPH W. SEISS.

Horse Hair.

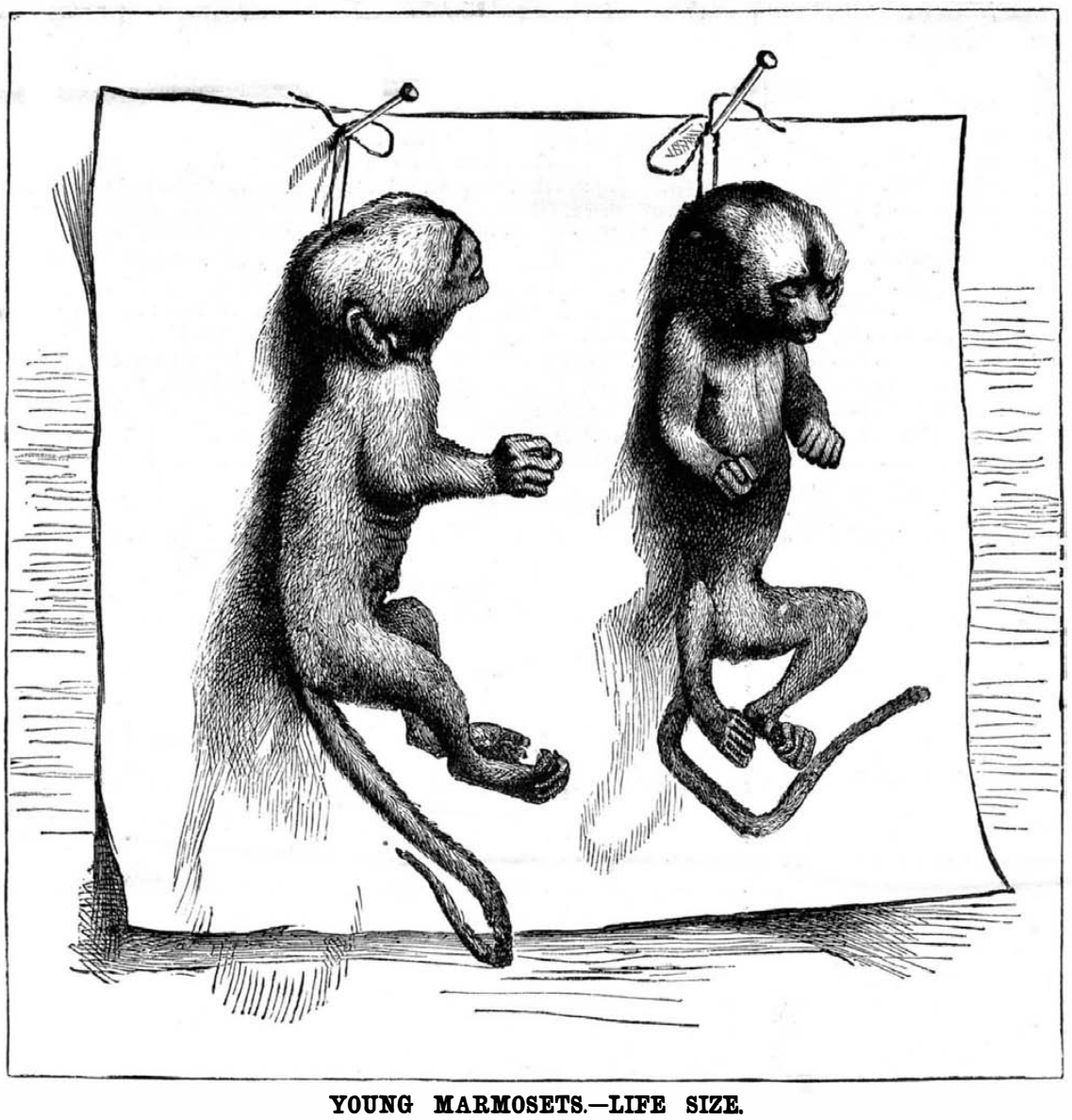
It appears that the great bulk of the horse hair used in the United States is imported from the Argentine Republic and Uruguay. The hair sells in Buenos Ayres and Monte Video at from 26 to 32 cents per pound, and is packed in bales weighing about 1,000 pounds, and costing from $250 to $300 each. The total amount imported in 1882 was 4,082,000 pounds, of which 3,417,000 pounds came from South America, 196,000 pounds from Mexico, and 469,000 pounds from Russia. In the previous year the importation was 3,643,972 pounds, and in 1880 nearly 4,000,000 pounds; but in 1879 it was not quite 2,000,000 pounds. Assuming an average price of 28 cents per pound, the amount imported last year into the United States would reach a total value of about $1,150,000. The bulk of this horse hair is manufactured by four or five concerns, one of which is in Boston, one in New York, one in Philadelphia, and one in Baltimore.

YOUNG MARMOSETS.

In the accompanying engraving we present to our readers, through the kindness of the London *Graphic*, an illustration of the marmosets (*Hapale jacchus*) recently born in England. These are claimed to be the first of their kind that have ever been bred in Europe, although this is disputed by some, owing to records of births of these curious monkeys some twenty or thirty years ago. It is questioned, however, whether the monkeys referred to were really marmosets.

Marmosets are very small in size and closely resemble the squirrel in shape and agility. The adult is about 8 inches in length, with a tail several inches longer than the body and quite bushy. The hair over the eyes also becomes quite long as the animal matures, and obscures the ears completely from view in front. They are natives of the southeastern portion of Brazil. In disposition they are rather timid, and are sensitive to the cold, their coats being fine and fleecy.

They cannot boast of a very high order of intelligence, and are principally attractive as pets for their playfulness and their gentle and insinuating ways. It is to be greatly regretted that the little fellows represented in our engraving should have succumbed so soon to the tribulations of this material existence, and that scientists should have been deprived of the pleasure of watching the different stages of their development.



YOUNG MARMOSETS.—LIFE SIZE.

Trimming the Elephant's Feet.

The whole of a day was spent recently at Bridgeport, Conn., by five men in trimming the feet of two elephants. The operation is performed, the New Haven *Register* says, once on the road, once in the fall, and again in the spring. The sole of an elephant's foot is covered with a thick, horny substance, which, as it grows thicker, tends to contract and crack, often laming the animal. At the time of trimming the elephant stands on three legs and places the foot to be operated upon across a large tub. Two men hold the leg down, and one stands at the animal's head to prevent him from turning. Then with a two-foot drawing knife one man shaves off great pieces of bone from the sole of the foot. The elephant holds the foot high of his own accord, seeming to understand what the men are doing, and after the operation he flourishes his trunk, trumpets, and expresses sincere thanks.

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Testing Boilers.

A writer in the Cincinnati *Artisan* adds his testimony as to the inefficiency of the hydraulic test in examining steam boilers as follows: This test is only valuable in bringing to notice defects which would escape ordinary inspection. It is not to be assumed that it in any way assures good workmanship or material, or good design, or proper proportions; it simply shows that the boiler being tested is able to withstand this pressure without leaking joints or distorting the shell to an injurious degree.

Bad workmanship may often be detected at a glance by an experienced person. The material must be judged by the tensile strength and ductility of the sample tested; the design and proportions to be judged on constructive grounds, and have little or nothing in common with the hydraulic test.

The great majority of buyers of steam boilers have but little knowledge on the subject of tests, and too often conclude that if they have a certified copy of a record showing that a particular boiler withstood a test of say 150 pounds, it is a good and safe boiler at 75 to 100 pounds steam pressure. If the boiler is a new one and by a reputable maker, that may be true; if it has been in use and put upon the market as a second hand boiler, it may be anything but safe at half the pressure named. By the hydraulic test, the braces in a boiler may be broken, joints strained so as to make them leak, bolts or pins may be sheared off or so distorted as to be of little or no service in resisting pressure when steam is on.

The practice of inspecting boilers by sounding with a hand hammer is in many repects to be commended. It requires some practical experience in order to detect blisters and the wasting of plates, by sound alone. The hammer is especially applicable to the thorough inspection of old boilers.

It frequently happens in making a test that a blow of the hand hammer will either distort it or be driven entirely through the plate; and it is just here that the superiority of this method of testing, over or in connection with the hydraulic test, becomes fully apparent. The writer once knew a locomotive which had been run into the repair shops for some slight repairs, and afterward was subjected to the usual hydraulic test and was found to be tight; it was then run into the round house for service, but before it was fired it was accidentally discovered by a boy's "fooling" around the fire box with a hand hammer that the plates which were originally five-sixteenths inch thick had been reduced in some places by corrosion to a thickness scarcely more than one-sixteenth inch. This incident is introduced by way of a digression simply to show the value of the hammer test and the insufficiency of a hydraulic test in the case of boilers which have been for some time in service.

The location of stays, joints, and boiler fittings all modify, and are apt to mislead the inspector if he depends upon sound alone. There is a certain spring of the hammer, and a clear ring indicative of sound plates, which are wanting in plates much corroded or blistered. The presence of scale on the inside of the boiler has a modifying action on the sound of the plate. When a supposed defect is discovered, a hole should be drilled through the sheet, by which its thickness may be determined as well as its condition.

The literature of boiler explosions is by no means scanty, and varies anywhere from sound practical experience to the most visionary idealism; but those who have most to do with steam boilers, and whose business it is to trace results to causes, are singularly unanimous in the opinion that almost without exception boiler explosions may be traced directly back to the causes—overpressure and neglect.

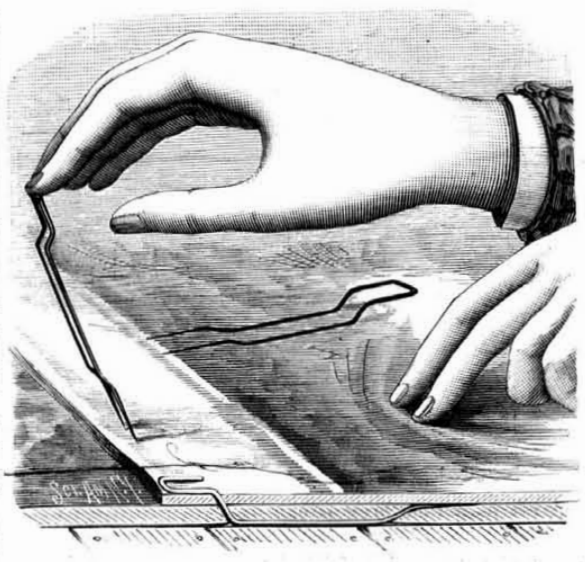
A Spring Motor.

An exhibition of a spring car motor was given at a recent date at the works of the United States Spring Car Motor Construction Company, Twelfth Street and Montgomery Avenue. As a practical illustration of the operation of the motor a large platform car, containing a number of invited guests and representatives of the press, was propelled on a track the length of the shop. The engine, if such it may be called, was of the size which is intended to be used on elevated railways. As constructed the motor combines with a stationary shaft a series of drums, carrying springs, and arranged so that they can be brought into use singly or in pairs. Each spring or section has sufficient capacity to run the car, and thus as one spring is used another is applied. There is a series of clutches by which the drums to which the springs are attached are connected with a master wheel, which transmits through a train of wheels the power of the springs to the axles of the truck wheels. The motor will be so constructed that it may be placed on a truck of the width of the cars at present in use, and will be nine feet long, with four traction wheels. It is proposed to do away with the two front wheels and platform, so that the front of the car may rest on a spring to the truck. There will be an engine at each end of the road, which, it is calculated, will wind up the springs in at least two minutes' time.

While the mere construction of such a working motor involved nothing new, the real problem involved consisted of the rolling of a piece of steel 300 feet long, 6 inches wide, and a quarter of an inch thick. Another element was the coiling of this strip of steel preliminary to tempering. To temper it straight was to expose the grain to unnecessary strain when wound in a close coil. To overcome this was the most difficult part of the work. At the exhibition the inventor gave an illustration of the method which has been employed by the company. The strip of steel is slowly passed through a retort heated by the admixture of gas and air at the point of ignition in proportions to produce intense heat. When the strip has been brought to almost a white heat, it is passed between two rollers of the coiling machine. It is then subjected to a powerful blast of compressed air and sprays of water, so that six inches from the machine the steel is cold enough for the hand to be placed on it. After this operation the spring is complete and ready to be placed on the shaft. The use of the springs is said to be beyond estimate. They may be employed to operate passenger elevators, the springs being wound by a hand crank. It is understood that the French Government has applied for them for running small yachts for harbor service. Among the advantages claimed for this motor are its cheapness in first cost and in operating expenses. It is estimated that an engine of twenty-five horse power will be required at the station to wind the springs. If there be one at each end of the line, the cost for fuel, engineer, and interest will not exceed $100 per week. This will answer for fifty or any additional number of cars. The company claims that by using twelve springs, each 150 feet in length, an ordinary street car can be driven about twenty miles.—*Phil. Inquirer.*

CARPET FASTENER.

The engraving shows a cheap and simple device by which druggets, mats, and other carpet covers may be readily fastened down. The fastener is of a staple-like form, having the separated ends sharpened, and made in one piece of



ALLEN'S CARPET FASTENER.

suitably-shaped wire. The parallel sides are bent as shown in the sectional drawing, the length of these bent portions nearest the points being less than the others, thereby placing the head part at a higher elevation. When the fastener is to be applied it is held nearly upright, the points being down and with its opposite raised end portions in front. The pointed ends are pushed through to the floor, when the upper part is lowered backward, and the fastener pressed forward and inward until the second bend is within a certain distance of the carpet. The thumb is then placed upon the head and a finger upon the drugget a little beyond the ends, when the ends are brought up through the carpet but not through the drugget, while the depressed sections of the sides rest upon the floor and the head section bears upon the drugget to hold it in place.

This invention has been patented by Mr. Charles E. Allen, whose address is Winsted, Conn.

Free Sulphuric Acid in Sulphate of Alumina.

Sulphate of alumina is taking the place of alum for many purposes. In paper making it is very essential that this salt should be free from acid, since the latter destroys ultramarine and injures the sizing by causing transparent spots. Oscar Miller has reported the results of his experiments in the Berlin *Berichte*, which show that methyl orange is the safest and best test for the free acid. With pure sulphate of alumina it produces only an orange color, but is very sensitive to *free* acid, with which it produces a rose color, or pink. Ethyl orange is more sensitive to free acid; but, in fact, too much so, as it turns pink with a neutral sulphate. Tropæoline is not sensitive enough. By extracting the acid with alcohol, and evaporating, the solution may be titrated with methyl orange.

The Electric Light in Theaters.

The Edison installation at Niblo's Garden consists of one K dynamo, 55 volts electro-motive force, capable of supplying current for 500 eight candle power B lamps. At each performance of "Excelsior," the Edison lights are in use as follows: 1st act, last scene, the electric torch held by the character "Light;" 2d act, last scene, the Brooklyn Bridge; 3d act, 1st scene, the discovery of the electric spark in Volta's laboratory. In the last scene the ballet dancers are provided with wands, each having an Edison lamp on the end, and festoons of lamps are lowered from the flies above. At a given signal the entire number of lamps—400—are lighted instantaneously, producing a magical effect of great brilliancy. To instantly light such an immense number of lamps at their proper candle power is a very severe test on the regulating capacity of the engine and the dynamo.

The Watch Manufacture in England.

The London *Times*, in a recent article on this subject, shows that there has been no real growth in watch making in England for the past hundred years. The methods of manufacture and the total production are now substantially the same as they were about a hundred years ago, and the great increase in the trade has been met by French, Swiss, and American manufacturers. The making of watches in France on a large scale is a comparatively modern industry. In 1850 the production at Besancon, the center of the French watch trade, only amounted to some 50,000 watches annually, whereas about ten times as many are now made there yearly. In Switzerland the annual production is now estimated to equal 3,500,000 watches, or an increase amounting to about a million watches a year within the past five years. But in estimating the extent of the English watch trade it is stated that, for 1880, the latest date for which complete returns had been published, the total number of watches made bearing the stamp of Goldsmiths' Hall was only 206,000, an output which is equaled by that of one American firm. The English watches are usually high-priced, and they meet a certain demand, largely from those who think they do not own a first-class timepiece unless it has cost a good deal of money, but the entire increase in the trade in England has been filled by watches of foreign manufacture.

The causes that retard the development of English watch making, as stated by the *Times*, are "defective organization and defective appliances. The method of manufacture and the tools employed are not substantially different from the method and the tools of 100 years ago. It is a natural consequence that the trade has shown no elasticity, and that in latter years it has found little custom at home. English watches are not made in sufficient quantities to justify the production on a large scale of any one particular type; the trade is for the most part in the hands of 'small men,' who make certain sizes in dozens and half dozens. In the Swiss and American factories a particular type, if it be considered worth making, is made by thousands; everything is organized for production on a large scale. Confining the contrast to English and American methods, the principal point upon which it is necessary to insist is that in America the twelve or fourteen trades which constitute watchmaking are aggregated under one roof and form one compact organization. By the older method still pursued in England, and until recently almost the rule in Switzerland, the different parts are transported from one workshop to another, in different quarters of the town, and even from one part of the country to another. Under the new method the *maximum* of efficiency and individual responsibility is obtained by the minute subdivision of every process; the loss of time in the transfer from one department to another is so minimized as to be practically non-existent."

Creosoted Wood Hard to Burn.

An establishment for creosoting piles and plank was recently burned in New York, when it was demonstrated that creosoting afforded considerable protection against fire. A correspondent says: "The building was of pine and spruce in their natural state, except the sills, which were made of creosoted pine. The latter were set on posts and raised about a foot above the ground, so that the flames had a chance to get under them; they were charred, yet retain their form and a certain amount of strength, whereas not a piece of the untreated lumber could be found. Scattered over the premises were numerous creosoted piles and several thousand feet of plank all charred, but the pieces mostly retained their original form and a certain degree of usefulness. Where the flames could reach the comparatively uninjected heart wood, they ate into it, leaving a charred creosoted shell. In all the above charred pieces the fire went out of itself; creosoted wood burns with a dense black smoke, which probably has a smothering effect."

Quinine from Gas Tar.

The last contribution of modern chemistry to science is the production of quinine from gas tar. Professor Fischer, of Munich, has succeeded in obtaining from distilled coal a white crystalline powder, which, as far as regards its action on the human system, cannot be distinguished from quinine except that it assimilates even more readily with the stomach. Its efficacy in reducing fever heat is said to be remarkable, even rendering the use of ice unnecessary. The importance of such a discovery as this consists not so much in the actual fact achieved as in the stimulus given to scientific research by the opening up of a new channel of investigation. The romance of gas tar is evidently far from being exhausted. In addition to the sweetest scents, the most brilliant dyes, the most powerful disinfectants, and even prussic acid are some of the numerous and wonderful products of its decomposition.

New Apparatus for Demonstrating Foucault's Current.

Prof. A. Von Waltenhofen has devised a simple apparatus for the above purpose, consisting of an electro-magnet which is fastened in a vertical position, and between the poles of which a copper pendulum oscillates. The copper plate has the form of a segment of a large flat ring, is eight inches long, 2 inches wide, and one-half inch thick, and is suspended by a sort of trapeze arrangement, so that it may pass exactly between the poles. The pendulum is set swinging, but as soon as the current is connected it goes very slowly, as if moving through a thick liquid, or stops entirely.—*Instrumentenkunde.*

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ENGINEERING INVENTIONS.

Improvements in air compressing engines form the subject of a patent issued to Mr. Friedrich Honigmann, of Aachen, Germany. The invention contemplates compressing air to ten or more atmospheres, and so that, by specially devised means, the air will also be highly heated.

An elevated endless single track railway has been patented by Messrs. William R. Bishop and Ryland W. Eames, of Columbus, Col. It cheapens construction by using a single rail, the cable is relieved of unnecessary weight by suspending the load from a car upon the track, and a rotary tramway is made, so increasing the capacity of performance.

An improved switch operator has been patented by Messrs. James H. Kennedy, of Iona Station, and Thomas P. Hall, of Toronto, Canada. It provides for a simple attachment to the locomotive, whereby the engineer can move the switch to turn the train on to a siding, and also for a similar attachment to be let down from the hind truck, whereby the switch can be shifted back after the train has passed on to the siding.

A grading machine has been patented by Mr. Lewis C. Gandy, of Humboldt, Neb. It is of simple and substantial construction, for grading and leveling earth in making the road bed of railways, having a cutter mounted on a frame by which it is drawn, said cutter being susceptible of easy adjustment for depth of cutting, and also a mould board for conducting earth to one side of the grade as may be desired.

MECHANICAL INVENTIONS.

An improved log roller or carrier has been patented by Messrs. Freeman S. Farr, and Joshua Evered, of Muskegon, Mich. By a movable stop combined with a canting arm, both fitted for operation by a steam cylinder, logs are more conveniently moved and held than heretofore, and are not liable to be thrown against the carriage blocks to break them, as now frequently happens.

A centrifugal pump has been patented by Mr. Christoffer A. Christensen, of Willamena, Oregon. It is of simple construction and easily variable capacity to lift sand, gravel, and other solid or pulpy substances without obstruction, and designed to be so worked as to utilize the applied power directly and to the best advantage.

AGRICULTURAL INVENTIONS.

A check row attachment for corn planters has been patented by Mr. Valentin Weber, of Princeville, Ill., intended to facilitate the planting of corn in accurate check row. By this invention a seed dropping slide is made to be operated by the passage of a check wire through a specially devised and arranged attachment.

MISCELLANEOUS INVENTIONS.

An improved riding saddle composed mostly of springs, which renders great relief to the horse and ease to the rider. Mr. Merlin Comstock, of Los Angeles, Cal., is the patentee.

An improvement in drawers has been patented by Mr. Charles Z. Celler, of New York city. Its object is to avoid heavy seams in the crotch and fly, and to strengthen these parts against ripping.

A paper bag and twine holder has been patented by Mr. Abbott M. Reeves, of Mansfield, Ill. It is an improved device for holding a ball of twine, and also to suspend convenient for use different sizes of paper bags or wrappers.

A powder flask has been patented by Mr. Paul Otto Kessler, of Darien, Ga., so constructed as to form a charger, by which the proper charge of powder can be automatically measured for any amount desired in filling cartridges or loading guns.

Mr. Emmet N. Barber, of Kent, Ohio, has patented a lumber measure that will accurately register the aggregate number of feet, board measure, of boards of any width and length, the length being known to the operator.

Mr. Henry Smith, of Newark, N. J., has patented an improvement in pearl buttons, with the design of providing a simple, convenient, neat, and effective means for connecting the pearl front of a button to its back.

Mr. J. R. King, of St. Paul, Minn., is the patentee of a combined paper weight, pin cushion, calendar, and pen rack, all of which are so adjusted one to another as to make a very convenient and ornamental article for the counting room desk.

An improved cartridge pouch has been patented by Mr. Oliver D. Collins, of Snow Hill, Md. To carry a large number of cartridges conveniently it provides a series of tubes united side by side, open at the upper ends, and provided at the lower ends with latches for holding or permitting the withdrawal of cartridges.

An improvement in fruit gatherers has been patented by Messrs. Jesse L. Talbot and Mr. Chesterfield J. Hiter, of Elizabethtown, Ky. Its object is to facilitate the gathering of such fruit as may be beyond reach from ordinary ladders, and prevent the fruit from being bruised while being gathered.

An improvement in picture mounts is the subject of a patent which has been issued to Mr. Stella A. Jackson, of New York city. The object of the invention is to secure a picture against a waxed back plate, so that dust will be effectually excluded, and the tints of the picture be preserved.

A fruit jar has been patented by Mr. Robert Malcom, of Cornwall, N. Y. It has a thickened neck, screw threaded internally, and with a groove on its upper surface; the cover is externally screw threaded, and presses a packing ring firmly into the groove in the top surface of the neck.

Mr. Hiram P. Pruim, of Grand Haven, Mich., has patented a new and improved breastpin, whereby the pin is made much stronger than one hinged in the usual manner, does not wear out so rapidly, and it is less apt to become disengaged than are pins of the usual construction.

A fruit drier has been patented by Elizabeth Shuts, of Casstown, O. The object of the invention is to provide an apparatus for drying all kinds of fruits and vegetables, and it is so constructed that it can be conveniently operated without danger of burning them.

An improved school desk and seat has been patented by Mr. William J. Jackson, of McComb, Miss. The desk can be adjusted vertically according to the size of the children to occupy it, can be swung upward to facilitate the sweeping of the room, or folded so as to occupy but little space.

An improved warp linking machine has been patented by Mr. Clayton Denn, of Philadelphia, Pa. In linking warps as delivered from warping machines the peculiar construction here patented provides for more rapid and efficient work than has heretofore been possible.

A blasting needle consisting of a needle made with a copper point to prevent striking fire, and with one or more holes through the opposite end for cutting off the end of the "squib," or straws used in priming the charge, is the subject of a patent granted to Mr. Ralph B. Platt, of St. Nicholas, Pa.

An improved door holder, or check, has been patented by Mr. Joseph A. Coultas, of Brooklyn, N. Y. The device is secured to the inside of the door, so as to hold it open at any desired position, against draughts of air, but when it is desired to close the door it works automatically and requires no attention.

A pearl button, with a perforated pearl front, the back having a countersunk perforation with an eyelet provided with a crossbar, so that the pearl front will not be disfigured by rivets or other means by securing it to the button back, is the subject of a patent granted to Mr. Henry Smith, of Newark, N. J.

An electric voting machine for legislative bodies has been patented by Mr. John A. Enos, of Peabody, Mass. It provides for an electrical apparatus by which each voter may cause his vote to be indicated on a dial, and his name displayed to view, by one and the same current of electricity.

An improvement in ore concentrators has been patented by Mr. Hinche P. Mabry, of Fort Worth, Tex. The object of the invention is to facilitate the removal of the lighter and worthless parts of the ore from the heavier and valuable parts by means of a peculiar arrangement giving a rotary shaft a longitudinal reciprocating or a rising and falling movement.

A fruit picker, more particularly designed for picking or clipping oranges, has been patented by Mr. Richard J. Morgan, of Orlando, Fla. Its construction is such that it is held and operated by certain fingers of one hand, while the remaining fingers are at liberty to grasp the fruit, leaving the other hand entirely free.

An improved stave jointer has been patented by Messrs. Julius F. Vogt and William C. Vogt, of St Louis, Mo. According to this invention an improved arrangement of the cutters is provided for, so that a gauge may be used, and the staves will be kept pressed against it, whereby they may be made uniform as to the width of the ends.

A horse checking and unchecking device has been patented by Mr. Daniel O. Cox, of Mannsville, N. Y. This is an improved arrangement whereby, from a peculiar construction and arrangement of parts connected with the harness, the driver can check or uncheck a horse harnessed to a vehicle without leaving his seat.

An elevator attachment to ship's gang platforms has been patented by Mr. Henry N. Pharr, of La Grange, Ark. It is intended to facilitate the delivery of goods by the use of steam power applied directly or through intermediate gearing, and is also designed for use in grading railroads, canals, and lawns, and in the construction of large buildings.

Mr. Francis Wayland Brown, of Rochester, N. Y., has patented a means for insulating, carrying, and laying electric wires under the ground. The pipe or trough in which the wires are laid is filled with coal dust, sand, resin, or other non-conducting substance closely packed, so that the wires are held in place firmly and surrounded with a substance which will not conduct the electric current from the wires.

An electric time lock has been patented by Mr. William Edgar Peirce, of Newark, N. J. It has a battery, the circuit wires with two breaks, one closed automatically by time mechanism and the other by hand, and both wires connected with an electro magnet having its armature connected with a catch lever engaging with the locking bolt, so that the latter will be released when both breaks in the circuit are closed.

A gas and coke kiln, principally as an improvement in making coal gas, has been patented by Mr. Hayden H. Hall, of New Hamburg, N. Y. The kiln has a removable cover at the top, a blast and exhaust pipe on the line of grate of charge receiving chamber, and another chamber below to receive the coke of each charge by the fall of the sectional floor or grate at the sides of the blast pipe.

Mr. Rudolph C. Koerber, of Austin, Tex., has patented a process for cleaning, tinting, and polishing pecan and other nuts. The nuts as brought in from the woods are carried up by an elevator, rapidly revolved in a cylinder, in which is common lye, sand or gravel, and water, then screened automatically, after which they are revolved in a second cylinder with suitable tinting material to restore the abraded nuts to their original color or an improved hue.

An excavator, for use in digging ditches, building roads, etc., to be used with either horse or steam power, has been patented by Mr. David Harper, of Jonesborough, Ark. Properly mounted on a suitably devised and firmly made truck, a wheel is made to revolve horizontally, with chains carrying buckets or scrapers attached to its outer rim, these being guided by one or two men in the scraping or digging, while a boy can attend to the dumping of the buckets as far off as the chains will reach.

Insurance.

The Ætna Life Insurance Company, of Hartford, Conn., have assets exceeding $28,000,000.

The Connecticut Fire Insurance Company, of Hartford, Conn., have surplus of $1,292,000.

The Phœnix Insurance Company, of Hartford, have paid over $16,400,000 in losses, and have nearly $4,500,000 of assets.

The Travelers' Insurance Company has written 908,000 general accident policies and has paid 93,000 claims for fatal or disabling injuries.

Dr. Talmage once remarked that "if a man can pay the premium on a policy of life insurance, it is a mean thing for him to go to heaven while his family goes into the poorhouse."

A company has been organized in Berlin, Germany, to restore lost articles to their owners or make good their value. How they propose to check bogus claims is not stated.

Financial.

Post, Wales & Co., 72 Broadway, New York, make a specialty of investment securities.

The Treasurer of the United States reports that the one and two dollar United States notes have increased during the last year $3,000,000, and that of the 28,000,000 silver dollars coined during the last year he has been able to pay out but $400,000.

Mammoth vaults are being constructed at the Washington Treasury capable of holding $45,000,000 in silver coin If the coinage continues at the present rate, it will not take long to fill it, as it has been found necessary to order a large amount taken away from the Boston Sub-Treasury to prevent the bursting of the vault.

The Secretary of the Treasury will recommend to Congress to retire the three-cent nickel piece. As this coin is about the size of a ten-cent piece, and as it was coined when we had a three-cent postage stamp, its days of usefulness are over.

Forster & Co., 6 Wall Street, New York, offer at par a limited amount of *Texas Siftings* Publishing Company's stock. See their advertisement in financial column.

Manufacturing Notes.

The Nicholson File Company, of Providence, R. I., are building an addition, 80 x 40 feet, two stories, for the manufacture of the finest grades of files for jewelers' use.

The Magee Furnace Company, Chelsea, Mass., are constructing a six story building, 66 x 100 feet, to be used as a stove mounting shop and for storage.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Auction Sale of Machinery.—In order to reduce our stock we will sell at auction at 10 o'clock A.M., Dec. 12, 1883, our stock of new and second-hand machinery at our branch warerooms, 207 and 209 Centre St., New York city. Tools consist of a first-class assortment, nearly every item new, and sale positive. We give below a partial list, viz.: Engine Lathes as follows, back-geared, screw cutting, power cross-feed, hollow spindle and compound rest: One 8′ x 22″, one 10′ x 20″, two 8′ x 20″, one 7′ x 20″, one 10′ x 18″, one 9′ x 18″, one 7′ x 18″, two 6′ x 18″, one 8′ x 17″, two 6′ x 16″, one 4½′ x 14″, one 4′ x 13″. Drill Presses, back-geared, quick return, power feed: One 32″, one 30″, one 28″, one 24″, one 20″, one 3-spindle drill, one 4-spindle drill, one No. 7 drill. Nut Tappers: Two 7-spindle and one 2-spindle machines. Speed Lathes: One 9′ x 15″, one 6′ x 16″, one 6′ x 15″, two 5′ x 14″. Iron Planers: One 7′ x 32″ x 25″, two 6′ x 24″ x 24″, two shaping machines, one 48″ radial drill, Betts Machine Co. make; No. 3, 60 lb. "Palmer" power hammer; one spinning lathe, three watchmakers' lathes, four milling machines, one 40 H. P. vertical engine, five small engines, four hydraulic jacks, twenty-four vises, ten lathe chucks, four bench lathes, five steam pumps, and many other items. Machinery can be examined at any time prior to sale. Send for catalogues. S. C. Forsaith & Co., Machinists and General Machine Dealers, Machester, N. H.

Useful information and tables on Steam and Water for Engineers and others contained in Blake's new illustrated catalogue of steam pumps and pumping engines, just published. Copies sent free. Address Geo. F. Blake Mfg. Co., 95 and 97 Liberty St., New York.

The wrapper for Blackwell's Durham Long Cut is unique. The foil, which effectively preserves the freshness and aroma of the tobacco, is stamped into a silken surface. At the top is the triumphant Durham Bull, symmetrical in figure and lordly in proportion. Beneath are the Pyramids, on whose top an ambitious sculptor is carving—not Excelsior, but which is the same thing—Durham. Enjoy the artistic design before passing it over to the children.

See adv. of Folding Basket, page 348.

To parties desiring to invest in a profitable manufacturing business (protected by letters patent and in successful operation), we would sell or exchange exclusive rights in territory too remote for us to handle to advantage. Address Arnd Mfg. Co., St. Louis, Mo.

For Sale.—Engine lathe, 15½ ft. bed, 28 in. swing; with blocks to swing 48 in.; back-geared, screw cutting; with usual fittings. Price, F. O. B. St. Louis, Mo., $500. S. C. Forsaith & Co., Manchester, N. H.

Pumps—Hand & Power, Boiler Pumps. The Goulds Mfg. Co., Seneca Falls, N. Y., and 15 Park Place, N. Y.

Microscopes, Microscopic Mounting Instruments, and Materials. Send for catalogue. Queen & Co., Phila.

Dies, Patterns, etc., Chas. A. Bailey, Middletown, Ct.

Steam Pipe and Boiler Covering, Roofing Paints, Prepared Roofing, and general line of Asbestos materials. Phil Carey & Co., 127 Central Avenue, Cincinnati, O.

For Sale.—Five patents entire. Nos. 235,844, 244,414, 254 251, 247,286, 238,545. Paper Pulp Engine. Pay as speciality. J. R. Abbe, Manchester, N. H.

Best Popular Science Works, 15 cents each. Catalogue free. J. Fitzgerald, 20 Lafayette Place, New York.

For Freight and Passenger Elevators send to L. S. Graves & Son, Rochester, N. Y.

Brush Electric Arc Lights and Storage Batteries. Twenty thousand Arc Lights already sold. Our largest machine gives 80 Arc Lights with 45 horse power. Our Storage Battery is the only practical one in the market. Brush Electric Co., Cleveland, O.

Cotton, Rubber, and Leather Belting, Rubber, Linen, and Cotton Hose; all sizes. Greene, Tweed & Co., N. Y.

Best Squaring Shears, Tinners', and Canners' Tools at Niagara Stamping and Tool Company, Buffalo, N. Y.

Lathes 14 in. swing, with and without back gears and screw. J. Birkenhead, Mansfield, Mass.

The Best.—The Dueber Watch Case.

If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN Patent Agency, 261 Broadway, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Lists 29, 30 & 31, describing 4,000 new and 2d-hand Machines, ready for distribution. State just what machines wanted. Forsaith & Co., Manchester, N. H., & N. Y. city.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N.H.

Railway and Machine Shop Equipment.
Send for Monthly Machinery List
to the George Place Machinery Company,
121 Chambers and 103 Reade Streets, New York.

"How to Keep Boilers Clean." Book sent *free* by James F. Hotchkiss, 84 John St., New York.

Wanted.—Patented articles or machinery to make and introduce. Gaynor & Fitzgerald, New Haven, Conn.

Water purified for all purposes, from household supplies to those of largest cities, by the improved filters manufactured by the Newark Filtering Co., 177 Commerce St., Newark, N. J.

Improved Skinner Portable Engines. Erie, Pa.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 80 to 88 Market St., Chicago, Ill.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Spy Glasses, Telescopes, Opera Glasses, Field Glasses. Send for catalogue. Queen & Co., Philadelphia.

Fossil Meal Composition, the leading non-conducting covering for boilers, pipes, etc. See adv., p. 350.

Woodwork'g Mach'y. Rollstone Mach. Co. Adv., p. 302.

Steam Pumps. See adv. Smith, Vaile & Co., p. 301.

Catalogues free.—Scientific Books, 100 pages; Electrical Books, 14 pages. E. & F. N. Spon, 35 Murray St., N. Y.

Straight Line Engine Co., Syracuse, N. Y. Best in design, materials, workmanship, governing; no packing.

Ajax Metal Company, Phila. Clamer's Ajax Metals for railroads, rolling mill, engine bearings, cocks, and valves.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Peck's Patent Drop Press. See adv. page 333.

Drop Forgings. Billings & Spencer Co. See adv., p. 333.

Bradley's Road Cart, Syracuse, N. Y. See p. 334.

Diamond Engineer, J. Dickinson, 64 Nassau St., N.Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Emerson's 1884 Book of Saws. New matter. 75,000. Free. Address Emerson, Smith & Co., Beaver Falls, Pa.

Hoisting Engines. Friction Clutch Pulleys, Cut-off Couplings. D. Frisbie & Co., Philadelphia, Pa.

Gould & Eberhardt's Machinists' Tools. See adv., p. 333.

Soapstone Packing, Empire Gum Core, and all Engine Packing. Greene, Tweed & Co., 118 Chambers St., N. Y.

Barrel, Keg, Hogshead, Stave Mach'y. See ad., p. 333.

Use King's Office Pen, patented July 31, 1883. Superior to all others. Price, $1 per gross, mailed free of postage. One dozen pens sent as samples on receipt of 10 cents. Geo. F. King & Merrill, 29 Hawley Street, Boston, Mass.

Magic Lanterns and Stereopticons of all kinds and prices. Views illustrating every subject for public exhibitions, Sunday schools, colleges, and home entertainment. 116 page illustrated catalogue free. McAllister, Manufacturing Optician, 49 Nassau St., New York.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 332.

Drop Hammers, Power Shears, Punching Presses, Die Sinkers. The Pratt & Whitney Co., Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 334.

Catechism of the Locomotive. 625 pages, 250 engravings. Most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for catalogue of railroad books. The Railroad Gazette, 73 B'way, N.Y.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Amateur Photographers can have their negatives printed or enlarged by Rockwood, No. 17 Union Square.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Stereopticons and Views for public and private exhibitions. Send for catalogue. Queen & Co., Phila.

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NEW BOOKS AND PUBLICATIONS.

THE ART OF TEA BLENDING. N. P. Fletcher & Co., Hartford, Conn.

The idea of tea blending arose from the fact that a more pleasing and satisfying beverage, and less costly, could be produced from a variety of teas scientifically mixed than could be obtained from any one tea. The book is intended as a hand book for the tea trade and a guide to tea merchants, brokers, dealers, and consumers in the secret of successful tea mixing.

ILLUSTRATED CATALOGUE. Drawing materials, Surveyors' instruments, etc. Keuffel & Esser, New York.

It is hard to imagine any want of draughtsmen and surveyors, in the way of tools and appliances for their work, for which this catalogue does not give a wide choice from which to supply the deficiency. And it is most beautifully gotten up, too, the engravings being original and made from drawings of the goods offered by the firm.

ARCHITECT'S AND BUILDER'S POCKET COMPANION AND PRICE BOOK. By Frank W. Vodges. Henry Carey Baird & Co., Philadelphia. Price $2.

Perhaps the best recommendation that can be made of this compact and meaty little pocket reference book is to state that seven thousand copies of former editions of it have been sold, thus encouraging the publishers now in its reissue, "enlarged, revised, and corrected." It is a little book which does not argue, but shows results in tables and formulas, rules and suggestions, and is carefully indexed.

THE TINMAN'S MANUAL AND BUILDER'S AND MECHANIC'S HANDBOOK. By I. R. Butts Seventh edition. Cupples, Upham & Company, Boston.

This is a book which has acquired no little popularity, because it gives in a simple manner, a great many valuable and practical directions to journeymen, without any pretense that most of the matter so presented is new or original. Receipts for the use of japanners and varnishers, directions for mechanical drawing, and numerous tables for artificers help to fill up the 200 pages.

PHYSICIAN'S DAILY POCKET RECORD. S. W. Butler, M.D. Published by *Medical and Surgical Reporter*, 115 South Seventh Street, Philadelphia, Pa.

The book is now in its eighteenth year, and is most favorably known among physicians. In addition to the blanks left for records are the metric system, general posological table, doses for hypodermic injection, inhalation, and for suppositories and pessaries, treatment in poisoning, poisonous bites and wounds, asphyxia and drowning, examination of the urine, and new remedies and pharmaceutical novelties. The book is of a convenient pocket size, bound in leather.

PLASTER AND PLASTERING; OR HOW TO MAKE AND USE MORTARS AND CEMENTS. By Fred. T. Hodgson. Industrial Publication Company, New York.

This little book is one of an industrial series issued by the same publishers, and is intended as a practical guide for those who follow the trade, as well as for the information of all having anything to do with the building industry. It mentions the characteristics and differences of the leading kinds of cements, describes the ordinary and some very little known methods of making plasters, gives rules for measuring and estimating on work, and presents several plates with elaborate designs in ornamental stucco work.

PATENT LAWS OF THE UNITED STATES. A Text Book. By Albert H. Walker. L. K. Strouse & Co., New York.

This book is written by a lawyer, for "the bar and the bench." It is a most elaborate and comprehensive exposition, from a professional standpoint, of the state of the law as it stands to-day, based on the Constitution and Statutes of the United States, and as interpreted in some twelve hundred and fifty Federal and State judicial decisions. Every page bristles with references to cases in which the rule of law has been decided or points of equity passed upon. The treatise is intended to "cover the entire field" of patent law practice, from the commencement of the government, and the first statute about patents enacted in 1790, down to September of the present year. In the appendix may be found the successive patent enactments, and various forms of patent pleadings. The book also bears evidence of thorough original investigation, as well as a great deal of hard labor. It cannot fail to be of great value to the old practitioner, and of almost incalculable benefit to the beginner.

DIE VERKEHRS-TELEGRAPHIE DER GEGENWART, MIT BESONDERER BERUCKSICHTIGUNG DER PRAXIS. (Telegraphic Intercourse of the Present.) Von J. Sack. Wien, Pesth, Leipzig: A. Hartleben. 1883. Pp. 303. Price 3 marks = 4 fr. 101 illustrations.

In the present volume, which forms the fifth of Hartleben's electro-technical library, we have a very concise, yet quite complete description of nearly every form of electrical telegraph used for communication between distant places. In the first chapter we have the needle and dial apparatus described; in the second the different registering and printing systems, including the Morse, Hughes, and Phelps; in the third the various relays are described; in the fourth the alarms employed to call the attention of the operator to the fact that a message is about to be sent. In the fifth chapter the automatic systems of Wheatstone, Little, Hefner-Alteneck, and Jaite are described, but the American systems, both the Leggo and Rapid, are omitted. The various duplex, quadruplex, and other multiplex systems are described in the sixth and seventh chapters, while the cable systems occupy the eighth chapter. The book is without index, and in many respects inferior to the other volumes of the series, but is nevertheless the best book for the price on this subject that we have seen. It should be studied in connection with vol. xiv. of the same series on "Telegraphic Conductors."

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

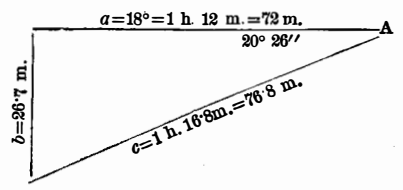
Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their indentification.

(1) G. J. H. writes: I have a machine for placing labels on round cans; could you give me a formula to make an adhesive matter that would pick up the label? I use glucose, but the atmosphere affects it, consequently the machine does not do its work regularly. A. The use of a soluble glue or a mucilage in combination with glycerine suggests itself as being suitable for your purpose. Soluble glue is prepared by dissolving glue in acetic acid, the vessel containing the mixture being kept in hot water until a perfect solution is produced.

(2) O. R. writes: I have a large celluloid mirror which in moving has become scratched and broken. Is there any way in which I can reseat the celluloid to bring it back to its former beauty and whiteness? A. The celluloid is polished in the same manner as ivory and horn. Dress out the scratches and finish up the broken place with pulverized pumice stone and water; then finish with a buff of soft leather and oxide of tin with water, and whiting and water to gloss with a rag.

(3) L. N. writes: Find time twilight begins and ends in latitude 40° 51′ north, when the sun's declination is 20° 25′ north. Zenith distance is 108°, or 18° below horizon. A. The duration of twilight for your latitude with the declination stated is 1 hour 17 minutes, at 18° depression for the ending. Authorities do not agree as to this amount by two or three degrees, nor can it possibly be an exact quantity, from the variations in the conditions of the atmosphere and the personal equation of the eye. Twilight being conceded to begin at sunset, by adding the duration above, the time of ending is obtained. The right angled triangle is formed by subtracting the sun's declination from the latitude when the sun is north, or adding when the sun is south. Using the hour angle equivalent to 18° for the leg a, then leg $b=a$ cot. A, and the $\sqrt{a^2+b^2}=c$, the hour angle required, as here illustrated:



(4) O. A. W. asks: Can I use a rubber tube to convey alcoholic vapors from the alembic to the condensers? A. Yes.

(5) H. D.—The reason why the needle points to the terrestrial pole is still one of the mysteries of the physical nature of magnetism and electricity. The terrestrial magnetic pole, or the strongest one, if there are two, as is claimed, is situated at about 75° north latitude and 85° west from Greenwich at the present time, and is still moving westward, or around a circle about 15° from the north pole. Observations show that the line of no variation has moved westward about 85° in 200 years, which if it continues will complete a rotation in from 800 to 900 years. The cause of the recession of the needle at any given point becomes apparent when you lay out the course of the magnetic pole around the terrestrial pole upon a globe, and view this circle from any place in mid latitude. You will see from the station at Paris that the western variation has now reached its limit and must commence to return. The change is slow at this time and variable from other causes. The azimuth of Polaris will continue to decrease for about 200 years, when its distance will be about half a degree, in conformity with the fact that in consequence of the precession of the equinoxes the north pole is swinging in a great circle among the stars, and will return to its present point in about 26,000 years.

(6) C. H. I., in writing of the bulging of the wall of a building in Boston, says he believes that the bulging of the front was owing to the greater contraction of the mortar in the back courses of brick rather than to the swelling of the thin joints of cement used in the front. Is this so? A. We are of the opinion that the Portland cement had but little to do with the bulging of the wall. It is the experience of New York builders that a close laid facing with Portland or any other cement requires a close, well laid backing. The weight of the whole front compresses the porous mortar backing, and will bulge a front not anchored.

(7) J. H. F. writes: In respect to a dispute about a brake attached to a cylinder on a stop cylinder printing press: Before the brake was attached there was always a slight quiver or shake when the cylinder stopped. But before the quickest feeder could place the sheet against the guides, the cylinder was perfectly still. I claim that attaching the brake does not affect the register, either in colored or book work; am I right? A. The shaking or vibration of the cylinder is generally caused by the back lash of loose gearing or gearing that has been worn. The brake is no doubt an improvement. If the amount of vibration was large, it would certainly affect the register, although you might not notice it; besides, the brake will tend to save wear upon the teeth, which is always greater when there is back lash.

(8) J. H. W. asks how many gallons of water are required for a steam boiler per horse power, say at 60 pounds pressure. A. At the Centennial Exhibition and tests, 30 pounds steam per horse power per hour was taken as standard; this is a little less than half a gallon, but it depends much on the character and condition of the engine through which the steam is worked. The quantity of water may vary from one-third of a gallon to two-thirds of a gallon and even one gallon in a very bad engine.

(9) A. M. L. writes: I use well water in my steam boiler and find it is gradually incrusting it. Croton water would cost three dollars per day or more, and I can pump water much cheaper. On the other hand I lose considerably on coal by incrustation in boiler and in frequent cleaning out. Can this be overcome? If so, what is the best remedy? A. If your water has much lime in its composition, you should blow off for a short time once or twice a day. Your engineer can judge, by observation of the delivery of blow off pipe, when it ceases to blow out lime or other deposit. Try gum gambier; it will tend to keep deposit loose, so that blowing may be effective. Use one pound of the gum, dissolved in water and pumped into boiler, to each ton of coal burned.

(10) H. P. writes: 1. Will one Grenet 12-inch cell (half a gallon) be sufficient to operate a Ruhmkorff induction coil, giving a four-fifths inch spark? A. Yes. 2. Would a smaller Grenet cell answer? A. One somewhat smaller might answer, but the larger one is to be preferred. 3. If the electrodes of such a coil should be placed so far apart that a spark could not pass, would there be any danger of a spark passing inside the coil through the coatings to spoil it? A. In a properly constructed coil there is no danger from internal discharges. 4. Would the coil sustain any other injury in such a case? A. No; but the perforation of the insulating coatings would render the coil useless. 5. Is there any particular make of these coils that is preferable to the others? A. Richie's coils are considered as satisfactory as any.

(11) L. O. B. asks: 1. Will the dynamo machine described in SUPPLEMENT, No. 161, be capable of charging the storage battery illustrated in SCIENTIFIC AMERICAN, No. 26, vol. xliv., sufficient to run one Edison lamp? And if so, for how long? A. The battery may be charged by the dynamo, but it would require considerable time. A battery of several elements would be required to run an Edison lamp. Better make one of the more recent storage batteries and charge it with a larger dynamo. 2. How can I increase the size of drawings to make dynamo of double the power? A. Increase the size fifty per cent, and wind with wire of the same size. It is advisable however to make the larger machine on the more recent plans of Siemens.

(12) R. H. S. asks how many pounds pressure a boiler made like the one illustrated on page 2891, in SUPPLEMENT, No. 182, ought to bear, and how many pounds of steam it will take to run an engine with 2 inches diameter of cylinder and 4 inches stroke. Also what thickness the casing of the above mentioned boiler should be? A. 1. It will be quite safe at 160 pounds pressure. 2. It will depend upon the amount of work you put on the engine. 3. The casing may be of sheet iron, say one-eighth of an inch thick, but it should be lined with fire tile or brick.

(13) B. T. W. asks: What, if anything, will prevent water from freezing, such as is kept for the purpose of extinguishing fires on bridges, boats, buildings, etc.? A. Salt is usually employed as an anti-refrigerant; a saturated solution of salt and water does not begin to freeze until near zero temperature. A partially or half saturated solution with 3 per cent glycerine in covered casks will probably serve your purpose.

(14) J. G. N. asks if the new invention for coating iron and steel with iridescent copper, vol. xlv., No. 5, page 70, July 30, 1881, could be used for brass, copper, or tin? If not, how could such effect be brought forward? A. As to the possibility of applying the mixture to brass, copper, or tin we are unable to say without experimenting. Puscher's solution for coloring metals is described as follows, and is probably quite as desirable as the one referred to: To prepare the solution dissolve 1½ ounces sodium hyposulphite in one pound water and add 1½ ounces lead acetate dissolved in half a pound of water. When this clear solution is heated to 190° to 210° Fah., it decomposes slowly and precipitates lead sulphide in brown flocs. If the metal is now immersed in it, a part of the lead sulphide is deposited thereon, and according to the length of time and consequent thickness of the deposited lead sulphide the various and beautiful luster colors are produced. In five minutes there may be imparted to brass articles a color varying from a beautiful gold to a copper red; then a carmine red; then dark, then light aniline blue, to a blue white like sulphide of lead; and at last a reddish white, according to the length of time they remain in the solution used. The colors possess the most beautiful luster, and if the articles to be colored have been previously thoroughly cleaned by means of acids and alkalies, they adhere so firmly that they may be operated on by the polishing steel. To produce an even coloring, the articles to be colored must be evenly heated. If, instead of lead acetate, an equal weight of sulphuric acid be added to the sodium hyposulphite, and the process carried on as before, the brass is covered with a very beautiful red, which is followed by a green, and changes finally to a splendid brown with green and red iris glitter.

(15) W. T. asks how to render printer's ink (which has been printed and become dry on the paper) again "wet," or as it was immediately after being printed, so that it would take bronze, as in ordinary printing with size and bronze. A. We know of no means by which an ink once printed can be softened again, for it dries by the evaporation of the volatile constituents, which cannot be added to the ink unless the mass be thoroughly mixed. Glycerine if added to an ink in proper proportions, according to the percentages of the other ingredients, will produce an ink which will not readily dry. The best and most satisfactory plan, however, would be to apply to a German maker of inks for an article such as you desire, an ink thinned with a suitable amount of size.

(16) W. W. S. H. writes: 1. Can you tell me how to temper mill picks? A. There is nothing peculiar in hardening mill picks, only that they should be as hard as possible and moderately tough. The greatest care should be taken to avoid burning the steel. Where there is much of this work to be done, the picks can be heated in a pot of cherry red hot lead, then dipped plumb into clear water at about 60°. Do not draw the temper. The hardening by the ordinary smith's fire can be well done if charcoal is used, and not hurried through the fire. Hurry burns the corners. Much also depends upon the shape of the pick, as to whether it is a sectional or leaf pick, or a thick, solid pick, the last being the most difficult to manage, on account of the sharp edge and thick back. They should be laid across the fire, so as to heat the eye as fast as the edge. 2. How much steam pressure is a boiler of the following dimensions capable of standing: Length of boiler 12 feet; diameter, 44 inches; has 48 lap welded tubes, 3 inches in diameter; has steam dome on top, 18 x 24 inches? The boiler is made out of charcoal iron $\frac{25}{100}$ of an inch thick. Longitudinal seams double riveted, other seams single riveted. Heads are ⅛ inch thick, well braced. It has been in constant use since June, 1875. It is free from scale, and has been well taken care of? A. We cannot advise as to pressure allowable on your boiler, as we do not know the condition. A new boiler would be allowed 98 lb. to 105 lb. 3. Give rule for finding proper size of steam pipe for steam engine. A. From ¼ to ⅓ the diameter of cylinder, according to the velocity at which engine is run.

(17) T. D. G. asks for the best method of tinning cast iron boxes before running the Babbitt metal in. I have used alcohol and sal ammoniac, and heated the casting until it fused the latter, but cannot get the tin to adhere to the casting. A. Make the inside of the boxes clean, wet the parts to be tinned with muriate of zinc and sal ammoniac, made by dissolving zinc in muriatic acid to saturation. Then add about 10 per cent of crude sal ammoniac pulverized—as soon as dissolved it is ready for use. Then put a piece of block tin in the box and heat until the tin is melted, then rub the tin over the surface with a stick of wood. Throw off the surplus.

(18) J. P. B. asks what are the average wages of a good journeyman machinist, and what are the wages of a good foreman machinist? A. The wages of journeymen machinists vary greatly, as with the experience and reliability that is found in the various grades of workmen. A first class man with a good character, capable of doing all kinds of work, will obtain $2.75 to $4.00 per day. The average mechanic gets from $2.00 to $2.50. Many get but $1.50. It is not easy to make an average that is of any value where the terms are so variable. Foremen get from $3.50 to $7.00 per day. This also is not satisfactory, as the man makes the price. It is impossible to lay down any rules on such matters, as the wages paid depend very greatly upon the expense of living in the locality in which the machinist is sojourning.

(19) J. D. G. asks: Will glass rubbing on a wire cable wear the cable as much as brass? A. Hard Bohemian glass has very little friction and wear when the pressure is light and lubricants are used. The only trouble will arise from heating and cracking. Neither glass nor brass will wear well or save a dry cable from wearing. We should prefer hardened steel or an alloy of 6 ounces tin to 16 ounces copper.

(20) T. V. G. asks: 1. If there is any difference, which would start and draw the heavier load—a locomotive with 7 foot drivers, or one with 3 foot drivers, both to be of same heft, and engine supposed to be strong enough to slip the drivers? A. Theoretically, no difference; but we think practically, 7 foot drivers. 2. Which would draw the more—a locomotive with six drivers or one with four drivers, both to have the same amount of weight upon drivers? A. Practically, a locomotive with six drivers.

(21) A. W. B.—The following is the formula for the mucilage said to be used on the United States postage stamps:

Dextrine	2 ounces.
Acetic acid	1 "
Water	5 "
Alcohol	1 "

Add the alcohol to the other ingredients when the dextrine is completely dissolved.

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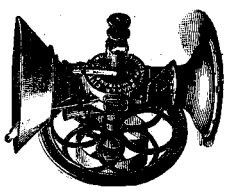

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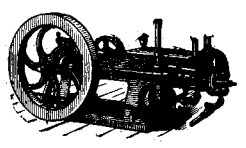

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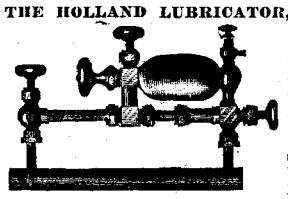

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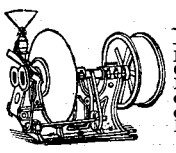

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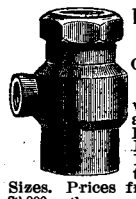

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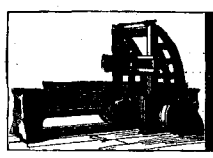

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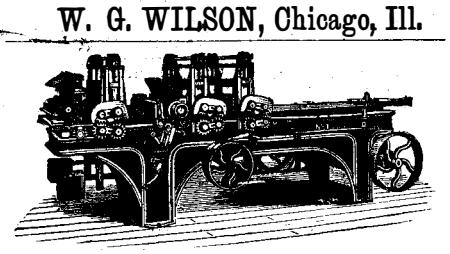

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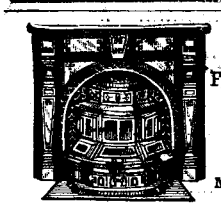

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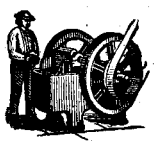

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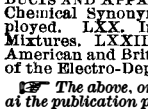

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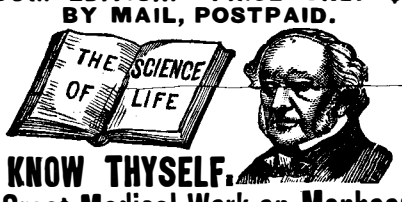

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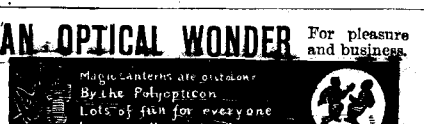

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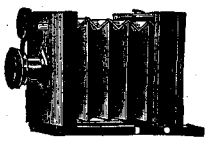

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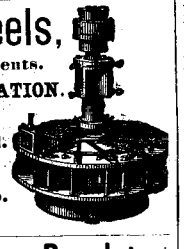

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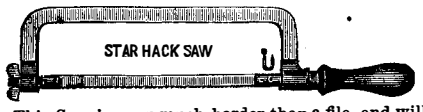

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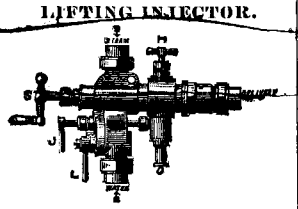

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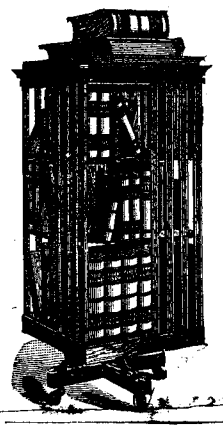

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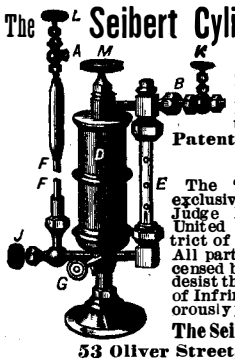

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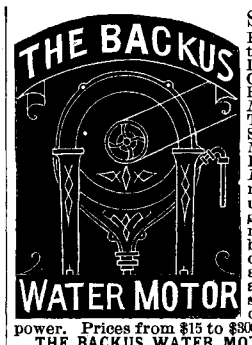

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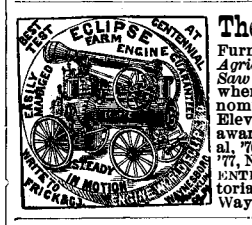

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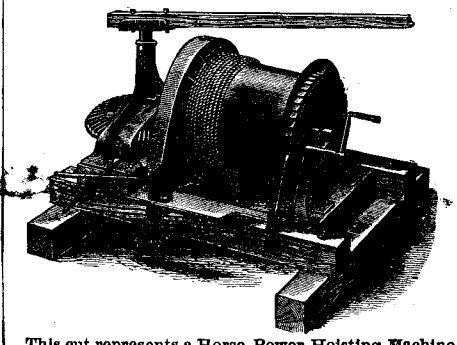

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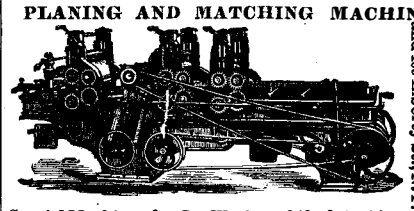

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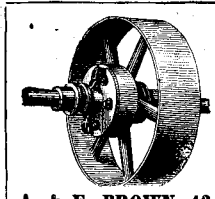

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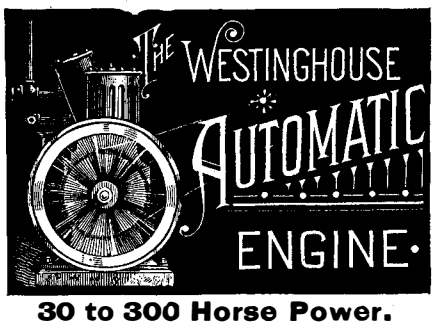

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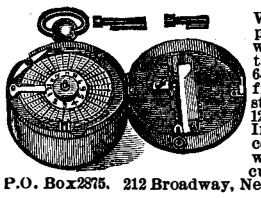

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